This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

3 2044 058 898 305

Digitized by Google

13d. Dec. 1913

HARVARD LAW LIBRARY

GIFT OF

U. S. Bureau of Insular Affairs

Received Feb 29 1913

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Nov. 25
649.S.
aek
c.

ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1900.

PART 12.

REPORT OF THE

MILITARY GOVERNOR OF CUBA ON CIVIL AFFAIRS.

IN TWO VOLUMES.

VOL. II—IN FOUR PARTS.

Part 4.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

Digitized by Google

OCT 23 1918

Digitized by Google

ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDING JUNE 30, 1900.

VOLUME I. Parts 1–13.—Report of the Secretary of War and all other reports except those of the Chief of Engineers and the Chief of Ordnance.

VOLUME II. Parts 1–8.—Report of the Chief of Engineers.

VOLUME III. Report of the Chief of Ordnance.

CONTENTS OF VOLUME I.

Part 1.—Reports, as follows:

Secretary of War.
Board of Ordnance and Fortification.
Commissioners of National Military Parks:
  Chickamauga and Chattanooga.
  Gettysburg.
  Shiloh.
  Vicksburg.
United States Military Academy, West Point, N. Y.:
  Board of Visitors.
  Superintendent.
Soldiers' Home, District of Columbia:
  Board of Commissioners.
  Inspector-General United States Army.
National Home for Disabled Volunteer Soldiers.

Part 2.—Reports of Bureau Chiefs:

Adjutant-General
Inspector-General.
Judge-Advocate-General.
Quartermaster-General.
Acting Commissary-General of Subsistence.
Surgeon-General.
Paymaster-General.
Chief Signal Officer.
Record and Pension Office.

Digitized by Google

Part 3.—Report of the Lieutenant-General Commanding the Army, and Department Commanders:
Lieutenant-General.
Adjutant-General.
Inspector-General.
Department of the East.
Department of the Lakes.
Department of the Missouri.
Department of Texas.
Department of Dakota.
Department of the Colorado.
Department of California.
Department of the Columbia.
Department of Alaska.
Division of Cuba:
Department of Matanzas and Santa Clara.
Department of Western Cuba.
Department of Santiago and Puerto Principe.
Department of Porto Rico.
Infantry and Cavalry School.
Cavalry and Light Artillery School.

Part 4.—Report of the Lieutenant-General Commanding the Army, and Department Commanders—Continued.
Department of Habana and military governor city of Habana.
Division of the Philippines (Major-General Otis).

Part 5.—Report of the Lieutenant-General Commanding the Army, and Department Commanders—Continued.
Division of the Philippines (Major-General MacArthur):
Department of Northern Luzon.
Department of Southern Luzon.
Department of Visayas.
Department of Mindanao and Jolo.

Part 6.—Report of the Lieutenant-General Commanding the Army—Continued.
Military operations in the Philippine Islands.

Part 7.—Report of the Lieutenant-General Commanding the Army—Continued.
Military operations in the Philippine Islands—Continued.

Part 8.—Report of the Lieutenant-General Commanding the Army—Continued.
Military operations in the Philippine Islands—Continued.

Part 9.—Report of the Lieutenant-General Commanding the Army—Continued.
Military operations in China.

Part 10.—Report of the Military Governor of the Philippine Islands, on civil affairs.

Part 11.—Report of the Military Governor of Cuba, on civil affairs.

Part 12.—Report of the Military Governor of Cuba, on civil affairs—Continued.

Part 13.—Report of the Military Governor of Porto Rico, on civil affairs.

Digitized by Google

REPORT OF THE MILITARY GOVERNOR OF CUBA ON CIVIL AFFAIRS.

IN TWO VOLUMES.

ARRANGEMENT OF CONTENTS.

PART 11.

VOLUME I—IN FOUR PARTS.

PART 1.

Personal report of Maj. Gen. Leonard Wood, U. S. V., military governor of the island of Cuba.
Report of First Lieut. Frank R. McCoy, Tenth U. S. Cavalry, aide-de-camp, on financial affairs.
Civil orders and circulars issued from Headquarters Division of Cuba during the year.

PART 2.

Report of Señor Diego Tamayo, secretary of state and government.
Report of Señor Guillermo Dolz, civil governor of the province of Pinar del Rio.
Report of Señor Emilio Nuñez, civil governor of the province of Habana.
Report of Señor P. G. Betancourt, civil governor of the province of Matanzas.
Report of Señor José Miguel Gomez, civil governor of the province of Santa Clara.
Report of Señor Lope Recio Loynaz, civil governor of the province of Puerto Principe.
Report of Señor Demetrio Castillo, civil governor of the province of Santiago de Cuba.
Report of Maj. William C. Gorgas, surgeon, U. S. A., chief sanitary officer of the city of Habana.
Report of Maj. Valery Havard, surgeon, U. S. A., chief surgeon, Division of Cuba.
Report of Maj. Edwin St. J. Greble, assistant adjutant-general, U. S. V., superintendent of the department of charities of the island of Cuba.

PART 3.

Report of Señor Leopoldo Cancio, secretary of finance of the island of Cuba.
Report of Maj. Eugene F. Ladd, quartermaster, U. S. V., treasurer of the island of Cuba.
Report of Maj. Edward C. Brooks, quartermaster, U. S. V., auditor for the island of Cuba.
Report of Maj. Tasker H. Bliss, commissary, U. S. A., collector of customs for the island of Cuba.
Report of Mr. M. C. Fosnes, director-general of posts for the island of Cuba.
Report of Señor Miguel Gener y Rincon, secretary of justice of the island of Cuba.
Report of Señor Carlos Revilla, fiscal of the supreme court of the island of Cuba.
Report of Maj. Edgar S. Dudley, judge-advocate, U. S. V., judge-advocate of the Division of Cuba.

Digitized by Google

PART 1.

Report of Señor Perfecto Lacoste, secretary of agriculture, commerce, and industries of the island of Cuba.
Report of Señor Enrique José Varona, secretary of public instruction of the island of Cuba.
Report of First Lieut. Matthew E. Hanna, Second U. S. Cavalry, acting commissioner of public schools for the island of Cuba.
Report of Señor Alejandro María López, acting superintendent of schools of the island of Cuba.

PART 12.

VOLUME II—IN FOUR PARTS.

PART 1.

Report of Señor José R. Villalón, secretary of public works of the island of Cuba, June 30, 1900.
Report of Señor Estéban Duque de Estrada, chief engineer, province of Pinar del Rio, June 30, 1900.
Report of Señor R. V. Molina, chief engineer, province of Habana, June 30, 1900.
Report of Señor Cosme de la Torriente, chief engineer, province of Matanzas, June 30, 1900.
Report of Señor D. Lombillo Clark, chief engineer, province of Santa Clara, June 30, 1900.
Report of Señor Pompeyo Sariol, chief engineer, province of Puerto Principe, June 30, 1900.
Report of Señor J. M. Portuondo, chief engineer, province of Santiago de Cuba, June 30, 1900.
Report of Señor José R. Villalón, secretary of public works of the island of Cuba, December 31, 1900.
Report of Señor Estéban Duque de Estrada, chief engineer, province of Pinar del Rio, December 31, 1900.
Report of Señor R. V. Molina, chief engineer, province of Habana, December 31, 1900.
Report of Señor D. Lombillo Clark, chief engineer, province of Matanzas, December 31, 1900.
Report of Señor Juan G. Peoli, chief engineer, province of Santa Clara, December 31, 1900.
Report of Señor Pompeyo Sariol, chief engineer, province of Puerto Principe, December 31, 1900.
Report of Señor J. M. Portuondo, chief engineer, province of Santiago de Cuba, December 31, 1900.

PART 2.

Report of Mr. William H. Carlson, special commissioner of railroads for the island of Cuba.
Report of Mr. E. J. Balbin, chief of the light-house board for the island of Cuba.
Report of Lieut. Commander Lucien Young, U. S. N., captain of the port of Habana.

PART 3.

Report of Maj. William M. Black, Corps of Engineers, U. S. A., chief engineer, Division of Cuba.

PART 4.

Report of Maj. William M. Black, Corps of Engineers, U. S. A., chief engineer, Division of Cuba.

Digitized by Google

CONTENTS.

VOLUME II—PART 4.

Report of Maj. William M. Black, Corps of Engineers, U. S. A., chief engineer, of the Division of Cuba. VII

Digitized by Google

Digitized by Google

Digitized by Google

SEA FRONT, HABANA. LA PUNTA AND MORRO CASTLE IN BACKGROUND.

Digitized by Google

REPORT

OF

MAJ. W. M. BLACK, U. S. A.,

CHIEF ENGINEER, DEPARTMENT OF CUBA, FOR THE SIX MONTHS ENDING DECEMBER 31, 1900.

HABANA, CUBA, *February 1, 1901.*

SIR: I have the honor to submit the following report of operations for the six months ending December 31, 1900.

Very respectfully, your obedient servant,

W. M. BLACK,
Major, Corps of Engineers, U. S. A.,
Chief Engineer, Department of Cuba.

The ADJUTANT-GENERAL,
Department of Cuba.

The public works in the island are executed in part by the department of public works, under the secretary of public works, and in part by the engineer and acting engineer officers of the military government. The work in Habana, both of the city and the state, with the exception of the repair of certain of the public buildings, has been placed in the charge of the engineer department of the Department of Cuba. In so far as has been practicable, engineering work through other parts of the island, excepting in garrisoned towns, has been in the charge of the department of public works. Where deemed necessary by the commanding general, isolated works were in charge of the acting engineer officers. These acting engineer officers were, during the continuance of the division of Cuba, under the direct orders of the various department commanders. Since the division of Cuba has been abolished they have been under the direct orders of the commanding officer, Department of Cuba. From time to time certain of the projects for work submitted by them have been sent to the chief engineer of the department for examination and report, but in general the work has been done without any supervision from this office, and credit for the results should be given to the department commander and to the officers themselves. Attention is invited to their reports. The works described in them are of many varieties, and it should be a cause of just pride for the Army and for the nation at large that its officers can accomplish such results in work so far out of the line of routine training. The duties which these officers have been called upon to fulfill have been onerous and in many cases uncongenial, and their reward is the consciousness of duty well done, the enhancement of their reputation for efficiency among their fellows, and the benefit obtained from

Digitized by Google

experience in meeting responsibilities of a wider range, in the organization of untrained men, unrestrained by military discipline, and in the direction and control of such forces for effective work. This experience will also be beneficial to the Army at large, in which prior to the Spanish war, few opportunities for development were attainable for the younger officers.

The following list shows the acting engineer officers and their stations at the end of December, 1900: C. J. Symmonds, captain and assistant quartermaster, U. S. Vols., Puerto Principe, Cuba; John S. Winn, first lieutenant, Second Cavalry, Mantanzas, Cuba; W. A. Raibourn, first lieutenant, Tenth Infantry, Cienfuegos, Cuba; H. F. Jackson, first lieutenant, Second Artillery, Quemados, Cuba; S. D. Rockenbach, first lieutenant, Tenth Cavalry, Santiago, Cuba; L. Hardeman, first lieutenant, Tenth Cavalry, Manzanillo, Cuba; R. G. Paxton, first lieutenant, Tenth Cavalry, Holguin, Cuba; M. O. Bigelow, first lieutenant, Eighth Cavalry, Guantanamo, Cuba; A. E. Kennington, second lieutenant, Tenth Cavalry, Baracoa, Cuba; G. S. Norvell, second lieutenant, Eighth Cavalry, San Luis, Cuba.

Early in January the following letter was sent from department headquarters to each officer:

SIR: The military governor directs me to inform you that hereafter all projects for work will be submitted by acting engineer officers, through the chief engineer of the department, to the military governor for approval; that reports of operations called for in Orders 155 and 249 will be submitted in duplicate, monthly, one to be sent through the immediate commanding officer to these headquarters, and one to the chief engineer of the department; that the chief engineer of the department is authorized to order acting engineer officers to perform journeys necessary for the inspection or execution of public works within the limits of the district to which the acting engineer officer is assigned; that orders for journeys outside of said district will be issued with the approval of the military governor.

Very respectfully,

H. L. SCOTT,
Adjutant-General.

The reports of the various officers named are herewith submitted. Lieut. M. O. Bigelow, acting engineer officer at Guantanamo, did not have charge of any work, and therefore made no report. The engineer work in the vicinity of Guantanamo (the water-supply system) was under the charge of the acting engineer officer at Santiago. Report submitted earlier by Lieut. Lochridge, who had been engineer officer at Santa Clara, is also inclosed.

The work under the charge of this department in Habana can be roughly divided into state work and municipal work. The state work was under the charge of the chief engineer of the department, and was carried on under the immediate direction of Messrs. A. H. Weber, T. L. Huston, and J. A. Sargent, assistant engineers. The municipal work was under the immediate charge of the chief engineer of the city of Habana, under the supervision of the chief engineer of the department. Mr. P. D. Cunningham, C. E., was city engineer until July 24, when he resigned to accept a more lucrative position in the United States. Lieut. W. J. Barden, Corps of Engineers, U. S. A., succeeded him, and has been in charge since that date.

In order to avoid a duplication of the office force and to secure more economical work the building construction branch of the office of the city engineer was placed under the charge of Mr. Huston, and had charge of all building construction and repair executed with island funds, whether on state or city property. For the same reason the

Digitized by Google

office force of the chief engineer of the department was limited to one clerk and one messenger, the necessary stenography, typewriting, translating, etc., being done by the office force of the city engineer; the pay and property divisions of the city engineer department also were used for the state work. The reports of Lieutenant Barden, and of Messrs. Weber, Huston, and Sargent are herewith submitted.

ENGINEER DEPARTMENT, CITY OF HABANA.

Lieutenant Barden's report on the work of the engineer department in the city of Habana gives in detail the operations of the past six months. Attention is invited to the reports of the heads of divisions of his office.

The work of the property and pay departments has been largely increased by the cumbersome method of accounting, particularly for property, required under existing orders. This method increases the cost of every work without providing additional security to the government. Money spent in this way is simply wasted. Every effort should be made to keep to the lowest figure consistent with safety against fraud the amount spent for office work. The recommendation is repeated that a system of accounting be adopted similar to that in use in the great corporations of the business world.

In the street department, very useful information has been obtained regarding brick and asphalt pavements, under the climatic and other conditions at Habana. The city will shortly be in possession of a good supply of excellent macadam stone from the discarded blocks of the old pavements, and the necessity for making the temporary macadam pavements from the limestone of the vicinity will be removed—removing also the vexed question of whether it is more economical to make the temporary macadam pavements of the cheaper stone, with the certainty of the requirement of early renewals, or to use an imported stone costing from two to three times as much, with a less cost of repairs. It is certain that in the streets of Habana any macadam pavement will prove very expensive to maintain, and that where placed it must be regarded as a luxury, for pleasure riding and driving; and heavy traffic must be excluded.

The work of the division of street cleaning and parks has been carried on with its accustomed efficiency. An interesting proof of the good work of this department is given by the absence from the city of the buzzards which in earlier days were so familiar a sight. The improvement of the state land around the portions of the old city wall which remain standing, around the Fuerza, and the formation of the new Punta Park, in all of which the military governor has been greatly interested, have been made by this division. Details of these works are given in Mr. Harper's reports. The most noteworthy work of the water and sewer division has been the construction of the Palatino pumping station, the elaboration of the plans for sewers and the preparation of the specifications for the sewer contract.

The specifications for sewering and paving the city were prepared under the direction of the chief engineer of the department by Lieutenant Barden, assisted by Mr. Keays, for the sewer work, and Messrs. McDonald and James for the paving. Assistance in this difficult work was most kindly given by engineers in the United States from whom information was requested, and thanks are especially due to Mr. Wm.

Digitized by Google

M. Brown, jr., chief engineer of the Metropolitan Sewage Commission of Boston, who sent plans and gave details of the Boston work, and also to the Edward P. Allis Company, of Milwaukee, who furnished valuable data as to the efficiency of pumping machinery. The latest specifications of the great cities of the United States were also studied, and particular use was made of the reports and specifications of the engineer department of Washington, D. C.

The Spanish laws governing public works of the state were amended and simplified in the spring of 1900, by Order No. 220, headquarters Division of Cuba, as noted in the last report, but the laws governing municipal contracts were left unchanged. After careful examination it was found to be inadvisable to let as important a contract as that for sewers and pavements in Habana in the manner prescribed for such work under the general laws. A draft of a new law for municipal contracts was prepared in this office and submitted to the military governor January 22. It is given in inclosure A. The military governor deemed it best not to make any general change in the law at that time, but prescribed that the contract for the particular work in question should be made in general accordance with the new law governing state public works, as shown in the following order, published in the Official Gazette of March 7, 1901:

HEADQUARTERS MILITARY GOVERNOR, ISLAND OF CUBA,
Habana, January 28, 1901.

GENTLEMEN: In view of the record of the proceedings prepared in the ayuntamiento of Habana in connection with the project for the sewering and paving of the city presented in the name of the firm of Michael J. Dady & Co., and:

Whereas the said project, according to which the works that were to be carried out would cost $12,600,000, was approved by the ayuntamiento and by the civil governor prior to the cessation of the sovereignty of Spain in Cuba was pending the approval of the general government of the island, in representation of the ministry of Ultramar, when, in consequence of the decree of December 14, 1898, of the last Spanish governor-general that ordered the suspension of certain concessions of municipal works or services that were to be carried out after the cessation of Spanish sovereignty.

Whereas the department of engineers of these headquarters afterwards made a study and prepared a project, with its corresponding plans for the sewering and paving of the city, comprising the wards of Vedado, Cerro, and Jesus del Monte, which were not comprised in the project presented in the name of Michael J. Dady & Co., and with a total cost of $9,135,583—or, that is, $3,000,000 less than the Dady project.

Whereas that this military government, by virtue of its being more practicable and advantageous for the city, the project prepared under its direction by the department of engineers of these headquarters than the one presented in the name of Michael J. Dady & Co., the latter was declared unacceptable and the former one approved, the same being forwarded to the ayuntamiento in order that, either as a modification of the Dady project or as a new one, the said corporation might examine it and say whether it accepted it or not, in order that in accordance with the same, in case of its being accepted, the work might be carried out with all possible dispatch.

Whereas the representative of Michael J. Dady & Co. accepted the project prepared by order of the government as a modification of their own, but increasing the price for the works to $10,600,000 in United States money, giving as a reason for this increase the necessity of including in the price certain amounts that were not taken into consideration in the estimate of the government project, such as the legitimate profit of the contractor, the cost of administration, that of engineers and inspection, the interest on money advanced, the interest on money deposited in guaranty during a period of four years of construction and preservation, the cost of preservation during five years after construction, the indemnification for damages caused to property, and the insurance on the lives of workmen.

Whereas the ayuntamiento accepted the so-called Government project as a modification of the one known as the Dady contract, and decided upon the specifications that should serve as a base for the awarding of the contract for the work, recognizing that the firm of Michael J. Dady & Co., by reason of being authors of a project had

Digitized by Google

the right of "tanteo," that of being exempted from making the required deposit on presenting their bids and that of being paid the value of their project, appraised by experts in the sum of $555,000 in case the contract should be awarded to any other party.

Whereas the municipal mayor, utilizing the right granted to him by the municipal law, suspended by decree of December 22, of the year last past, the compliance with said resolution, on the grounds that the right of "tanteo," that of making bids without depositing the prescribed amount and that of being indemnified to the amount stipulated as the value of the project, were detrimental to the city; which decree of suspension was approved by that of the civil governor of the province of the 29th of the said month; the matter being forwarded to this military government for final decision.

Whereas for the purpose of removing difficulties, saving the city from the losses pointed out by the municipal mayor in his decree of suspension, as well as also those no less apparent, that the delay in carrying out the work of sewering and paving would cause it, the said work being regarded as of urgent necessity by public opinion, by the ayuntamiento, and by this military government, an agreement has been entered into with Mr. Michael J. Dady, in representation of the firm of Michael J. Dady & Co., whereby the aforesaid Dady is to receive in his said character from this military government $250,000, United States money, as payment in full for the value of his project, and of everything else that by virtue of the same he may have expended for any reason whatsoever; and in consequence of the approval and payment agreed upon of the same sum has absolutely renounced in favor of this military government all rights and actions that might pertain to him in law or in equity against the ayuntamiento or the members thereof, present or past, or against the military government of this island, present or past, or against the Spanish government that existed in this island until the end of the year 1898; this military government consequently becoming possessed of all rights and privileges, in law or in equity, that the ayuntamiento has recognized in favor of the aforesaid firm of Michael J. Dady & Co., which agreement is contained in the deed now being prepared for execution before the Government notary, Mr. Fernando Vidal;

And in consideration that the carrying out of the works of the sewering and paving this city is of urgent necessity;

And in consideration that if the resolution of the ayuntamiento that is referred to by the decree of suspension were approved the interests of the city would suffer great losses, because, with the right of "tanteo," the exemption from furnishing bond on making bids, and the great indemnity of $555,000 as the price of the project, being recognized in favor of the firm of Michael J. Dady & Co., it would be difficult, or impossible, to secure other bidders who did not have like privileges, and, therefore, the advantages for the city of competition at the time of awarding the contract would disappear, whereby the aforesaid firm would have de facto a real monopoly;

And in consideration that the agreement entered into between this military government and Mr. Dady in his aforesaid character, by virtue of which agreement the rights, actions, and privileges that might pertain in law or equity to the latter are vested in the former, the city being greatly benefited, inasmuch as this military government, which has entered into the said agreement for the benefit of the latter, does not propose to take advantage of the said rights, actions and privileges, but only to be indemnified for the $250,000 in United States money paid to the aforesaid Dady in his said character, which indemnity is very much less than that which for the same reason had been stipulated by the experts and accepted by the ayuntamiento; the said indemnity having to be made by the person, corporation, or entity that may receive the award of the contract;

And in consideration that the agreement entered into between this military government and Mr. Dady as representative of Michael J. Dady & Co., gives a new aspect to the matter, modifying the resolutions of the ayuntamiento inasmuch as it suppresses all that which they might contain which might be detrimental to the interests of the city and as a natural consequence causes to disappear the grounds for the decree of suspension issued by the mayor and that of confirmation thereof issued by the civil governor; which decrees and resolutions in their modified parts are made de facto null and void;

And in consideration that in the estimate of the project of the Government certain sums have not been considered, which it is natural the bidders on making their proposals should take into consideration; such as the interest on the money deposited, the insurance of the lives of workmen, etc., this military government has

Resolved, First. To declare null and void the resolutions of the ayuntamiento and the specifications for the award of the contract in so far as they recognize the firm of Michael J. Dady & Co. to have the right of "tanteo," that of making bids for the

Digitized by Google

contract without first depositing the prescribed bond and that of being paid $555,000 as the value of the project for sewering and paving for which the contract is to be awarded; and to approve the said resolution and specifications for the contract in all other points contained therein with the modifications herein established in the "pliego de condiciones," established by this military government and which are herewith remitted.

Second. To declare null and void the decree of suspension issued by the mayor and that of the civil governor confirming the same, inasmuch as their purpose is now ended by the new aspect of the matter.

Third. That the award of the contract for the works of sewering and paving this city in accordance with the project and plans sent by this government be proceeded with without delay and the contract awarded to the lowest responsible bidder, the city reserving the right to reject any and all bids; the necessary advertisements to be made for forty days in advance, with the understanding that all bidders shall have equal rights, without that of "tanteo" nor exemption of furnishing bond for anyone who may make bids, all of whom, without distinction, must deposit prior to the opening of the bids 5 per cent of the price that serves as a basis for the same, in United States money or bonds of the United States, or in mortgage bonds of the ayuntamiento of Havana at their market value; that the party to whom shall be awarded the contract shall be under obligation to add to the said deposit another 5 per cent in any one of the three kinds of security before mentioned, in order to complete the final bond of 10 per cent of the total amount of the bids whereby he guarantees the execution of the same, and that within ten days of the award of the contract he must pay to the military government $250,000 in United States money in the nature of an indemnity for the value of the project paid in advance by this government to the firm of Michael J. Dady & Co., through its representative, Michael J. Dady.

Fourth. It is hereby ordered that the requirements and methods of procedure concerning the advertisements which shall be made for the award of contracts to make bids, to open or close the bids, to award the contract, to deposit the security, and to execute all that which is mentioned in the project and contract, shall be governed by the rules set forth in the specifications of this military government, which is forwarded to the ayuntamiento together with this decision; and in all matters not provided for and specified in said specifications the rules and procedure set forth in orders from these headquarters, Nos. 215 and 220, series 1900, shall be applied, the laws and legal provisions in so far as same are antagonistic to said orders not being applicable to the present case; but the conditions of dependence and subordination shall continue in accordance with said laws and legal rulings under which the ayuntamiento is in its relations to this military government which assumes all the rights that prior to the 1st of January, 1899, pertained to the ministry of Ultramar, and the general government of this island in the matter.

Very respectfully,

LEONARD WOOD,
Major-General, Military Governor.

TO HIS HONOR THE MAYOR AND CITY COUNCIL, *City of Havana.*

The general instructions for bidders and the general conditions of the specifications were framed in accordance therewith (see Inclosure B). The amount of the guaranty in the proposal and of the security required for the contract were fixed in general conformity to the old municipal law at about one-twentieth and one-tenth of the estimated total consideration of the contract at the request of the city authorities. The same reason caused the requirement that cash or bonds should be deposited as security, the former custom of requiring the deposit of bonds of the city of Havana being modified and broadened so as to allow the deposit of bonds of the United States as well. The general conditions were finally adopted and published after many conferences between the ayuntamiento, the military governor, and the engineers of the military government, extending through a series of months, and are in general conformity with the requirements of Order No. 220, series of 1900, before mentioned, and the general practice in the United States. Though the cost of the sewers and pavements will be increased by some of the requirements, that result was necessitated by the con-

Digitized by Google

ditions existing in Havana. The special conditions were drawn up in the office of the engineers of the military government and were but slightly modified. In draughting them every effort was made to provide for materials and methods which have been accepted as the best in general engineering practice, and to exclude those which are experimental in character or from which the finished work is not fully recognized as of the best class. As was inevitable and foreseen, many protests have been made by dealers in products excluded under these specifications, and the weight to be given these protests should be that usually allowed to ex parte statements from persons more interested in private gain than in the public good. The entire work of preparing the project for sewering and paving the city, and of preparing, adopting, and publishing the specifications therefor, has been arduous and unpleasant to a degree which can be fully appreciated only by those whose official duties required their participation therein.

[Inclosure A.]

DRAFT OF A LAW SUBMITTED TO THE MILITARY GOVERNOR JANUARY 22, 1901, TO GOVERN MUNICIPAL CONTRACTS, TO TAKE THE PLACE OF EXISTING SPANISH LAWS.

1. When the council of a municipality decides on the execution of any work of improvement a special project must first be formed, which shall state the general object to be attained by the work, the specific measures or constructions necessary for this object, with the plans and maps necessary for a complete understanding of the subject, and an itemized estimate of cost. For all works of an engineering character, for which the projects were not prepared by the chief engineer of the municipality (or the official charged with the duties of a chief engineer), this project must be accompanied by a report in writing from the said official, with his recommendations thereon, all of which must have been considered by the council before arriving at its decision.

2. When the project, as approved by the council, does not conform to the opinion of said chief engineer it must be forwarded to the governor of the province for his action, which shall be final, unless the case be appealed to the governor of the island by either the municipality or the said chief engineer, and excepting in the cases provided for in paragraph 3.

3. In cases of works of importance the project must be forwarded to the governor of the province, and having been acted on by him, must then be forwarded by him to the governor of the island, who will make the final decision after having heard a report thereon from the secretary of public works. All works will be considered works of importance, within the meaning of this paragraph, when their execution will require an expenditure of more than 25 cents American currency per unit of the population of the municipality as shown by the last preceding census, or when the money for their execution can not be paid from the ordinary municipal budget, but must be made the object of a loan or an issue of bonds.

4. When the work which is to be performed affects two or more municipalities the measures stated in the preceding paragraphs must be taken in each municipality, correspondence between the municipalities being carried on through the provincial governor in case both municipalities lie in the same province, the said governor taking such action as may be necessary to reconcile differences. In case municipalities lie in different provinces the necessary correspondence will be carried on through the respective provincial governors, and differences will be reconciled by the governor of the island.

CONCESSIONS.

5. All rights which a municipality now has or hereafter may acquire in and to any water front, ferriage, wharves, quays, docks, streets, avenues, parks, bridges, buildings, and in or to all public places are hereby declared to be inalienable, except by an affirmative vote of four-fifths of the members of the council, with the approval of the mayor; but they may be made the subject of a concession or franchise, as provided in this law, but all such proceedings shall be subject to the provisions of paragraph 3.

Digitized by Google

6. All concessions, franchises, rights, or grants for the use of public places wholly within the municipal limits, or for privileges of any character to be exercised exclusively within the said limits, shall be granted or made by the municipality only, subject to the provisions of paragraph 3.

Concessions, franchises, rights, or grants involving the use of public places lying both within and without the municipal limits, or involving privileges to be exercised both within and without the said limits, shall be granted or made by the State. Before the State grants or make sany such concession, franchise, right, or grant the project for the same must be submitted to the municipal council for examination and report, which report must be made within the period of thirty days. If the municipal council by vote of two-thirds of its members, approved by the mayor, shall be opposed to the concession, franchise, right, or grant, even though it originated with the central government, the municipality may commence an administrative appeal (recurso contencioso-administrativo) in the manner provided by law.

The municipality may by ordinance make such reasonable regulations as the public interests require governing the manner and places in which the rights granted or ceded by any such concession, franchise, or grant may be exercised within the municipal limits.

7. The municipality may not grant or make any concession, franchise, right, or grant for a term of more than twenty-five years. Each concession, franchise, right, or grant granted or made by the municipality must contain the condition that upon its termination such of the property of the concessioner or grantee as is located in, on, under, or over any public place shall pass to the municipality, either with or without payment therefor; and it may also contain the further condition that all the property of the concessioner or grantee in any way used in connection with the business it carries on in pursuance thereof shall pass to the municipality, either with or without paying compensation therefor; but no such payment may be made by the municipality because of any real or assumed value of such concession, franchise, grant, or right itself. In cases where payments are to be made by the municipality the manner of determining the amount therefor shall be specified in the concession, franchise, grant, or right itself.

Every such concession, franchise, right, or grant shall contain the necessary clauses to insure, by the penalty of forfeiture and otherwise, a strict compliance with its terms, an efficient public service at equitable rates and the maintenance of the property in good order during its continuance, and to permit the improvements rendered possible from time to time by new inventions or methods.

8. The parties who are the grantees of, or have the use or usufruct of, any concession, franchise, right, or grant shall keep books of account and shall annually make a report of all their financial transactions and condition to the municipal treasurer in such form as the latter may direct. The municipal treasurer may at any time in person or by deputy examine the books and accounts of said parties.

9. Each concession, franchise, right, or grant made or granted by a municipality shall be made or granted by public bids after publishing a notice for at least three times a week for one month in not less than two papers published, one in the municipality in question and one in the city of Habana, stating that the terms thereof are open to public inspection in the office of the secretary of the council, and also stating the time and place of opening the bids therefor. No bid presented after the hour set therefor in said notice shall be received or considered.

All bids must be accompanied by a certificate from the municipal treasurer that the bidder has deposited in the municipal treasury cash, or bonds of the municipality, or of the city of Habana, or of the United States equal to the amount determined by the municipal council and published in said notice; said valuation of the bonds to be determined by the average market value of the bonds in question in the Habana stock exchange during the month preceding the date. Such amount shall not be less than 5 per cent of the estimated cost of the work authorized by such grant, nor in any case less than $10,000. The municipal council may reject any or all bids and republish for bids for such grant, but it may not accept any bid except the one most advantageous to the municipality.

No concession, franchise, grant, or proprietory right shall be granted or made to any councilman, officer, or employee of the municipality, or to any firm, partnership, or association of which such councilman, official, or employee is a member, or to any corporation of which he is an officer or by which he is employed in any capacity.

10. When any cash or bonds are deposited as set out in the preceding article they may be returned only as provided in this article.

When any bid is rejected such deposit shall be returned to the bidder who deposited it, on the certificate of such rejection by the secretary of the council. When a

Digitized by Google

bid is accepted one-half of such cash or bonds deposited shall be returned to the successful bidder on the certificate of the chief engineer, approved by the mayor, that one-half of the work is completed in accordance with the terms stipulated; the other half shall remain as a deposit until the chief engineer, the corporation council, and the mayor shall jointly certify that all the work has been fully completed in accordance with all the terms of the grant.

If the municipal treasurer shall not receive such last-named certificate within the time provided by the grant for the completion of the work by the grantee, or if no such time is stated in the grant within five years after the grant is made, the balance of such deposit remaining shall be forfeited to the municipality, and the treasurer shall place the same among its general funds.

11. Any sum stipulated to be paid to the municipality for any such concession, franchise, grant, or right shall be paid in addition to the taxes imposed by the general law of taxation; and no provision in such concession, franchise, grant, or right shall limit the power of the State to impose taxes, or to authorize the municipality to impose taxes on the grantees or on those who have the use or usufruct of such concession.

MUNICIPAL CONTRACTS.

12. Every contract for public improvement or repairs shall be based on a detailed estimate of the cost of such improvement or repairs. The municipality may not make any contract except in the manner determined in this law; all contracts made otherwise shall be void.

13. The municipality may not enter into any contract for services rendered or to be rendered, or for supplying material for a period which may exceed one year, except that under extraordinary circumstances the municipal council may authorize a contract for a term not to exceed five years at the most.

14. All contracts, except those for services, must be based on specifications prepared as hereinafter prescribed, and be let in the manner set out in this law.

15. No contract shall be entered into until after an appropriation has been made therefor, nor in excess of the amount appropriated: *Provided, however*, That in case of an extensive single improvement, for which it would be advantageous and economical to enter into a single contract, the execution of which would extend over more than one year, and the payments of which could be met from the current revenues of those years, or from the sale of municipal bonds, a continuous contract may be entered into for the entire work, with the proviso, however, that the total contract price shall not exceed a certain fixed sum, and that the cost of the work done in each fiscal year shall not be in excess of the amount specified for that year.

16. A purchase of supplies or engagement of services may be made only in one of the following ways:

(1) By a written contract signed by the contracting parties. Such agreements are termed "formal contracts" in this law.

(2) By written proposal and written acceptance.

(3) By oral agreement.

17. When the municipality authorizes any improvement or repairs, or purchases any supplies, or engages any services other than those of a consulting professional expert, the cost of which will amount to $1,000 or more, it shall proceed as follows:

I. It shall advertise the bids for a period of two weeks once a week, or if the estimated cost exceed $5,000, at least four weeks once a week, in the official municipal newspaper; and in addition it may advertise in such other or foreign papers as may be authorized by a board composed of the mayor, city treasurer, and the head of the department (or chief of the section) interested and of which the secretary of the mayor shall be recorder, which shall be known as the contract board.

II. All advertisements for bids shall state where the conditions and specifications may be seen and examined, the time and place for opening bids, and the nature of the articles or services required. Said conditions and specifications shall be prepared by the head of the department or other branch of the administrative service under whose supervision the work is to be performed or to whom the articles are to be delivered, and shall be approved by the contract board provided for in Section I; they shall state that the articles to be contracted for shall be delivered in such quantities and at such time and place as the said head of department or chief of the section shall direct; that only one bid shall be received from the same party; that all articles which do not comply exactly with the conditions may be rejected; that transfers of contracts or of interests in contracts shall not be permitted; that 10 per cent will be retained from each partial payment until the satisfactory completion of the contract; that the place of residence of every bidder and his post-office address must be given after his signature; that all prices must be written as well as expressed in

Digitized by Google

figures; that bidders are invited to be present at the opening of all bids; and whether bids are to be made on the articles or services required in the aggregate or by classes or on each item separately. If the conditions and specifications call for bids in the aggregate or by classes, they may thus join only such articles as are usually kept for sale by one dealer, or such services as are usually performed by one branch of trade.

III. The bids shall be filed with the clerk of contract board, sealed, at or before 12 o'clock noon of the day set therefor in the advertisement, and no bids presented after that hour shall be received or considered.

IV. The bids shall be publicly opened, at noon or as soon thereafter as practicable of the last day set for filing them, by the clerk of the contract board, who shall immediately read each of them aloud, record a copy of each of them in a book provided for that purpose, and forward all of them to the head of the department or other branch of the administrative service under whose supervision the articles or services bid for are to be furnished or performed.

V. Upon the receipt of such bids the head of the department or other branch of the administrative service shall immediately examine them, and forward them with his report thereon to the contract board.

VI. The contract board may reject any or all bids, but may accept only that of the lowest responsible bona fide bidder whose proposal for furnishing the required articles or services is not unreasonable; and the clerk of said board shall immediately notify the successful bidder that his bid is accepted.

VII. The successful bidder must thereupon enter into a formal contract with the municipality in accordance with the terms of his bid and of the conditions and specifications under which it was made. Such formal contract shall be approved as to form by the corporation council and shall be executed by the mayor on behalf of the municipality, and by the successful bidder, in quadruplicate. One copy thereof shall be filed with the municipal treasurer, one with the clerk of the contract board, one shall be given to the contractor and another to the head of the department or other branch of the administrative service under whose supervision the articles are to be furnished or the services performed.

18. When the municipality authorizes any improvement or repairs, or purchases any supplies, or engages any services other than those of a consulting professional expert, the cost of which equals or exceeds $250 but does not amount to $1,000, it shall proceed as prescribed in the preceding article, with the following exceptions:

I. The powers therein given by Section III and IV to the clerk of the contract board shall be exercised by the employee designated for that purpose by the head of the department or other branch of the administrative service under whose direction the articles desired are to be delivered or the services are to be performed.

II. An employee designated for that purpose by the appropriate head of the department or of the branch of the administrative service shall perform the duties of said head as set out in Paragraphs IV and V; and said head shall have the duties and powers conferred upon the contract board and the mayor in Paragraphs VI and VII.

III. Supplies may be procured and services engaged either by written proposal and written acceptance or by oral agreement by the head of the department or other branch of the administrative service in the manner common among business men, either with or without advertising for bids in any of the following cases:

(1) When the public exigencies require immediate delivery of supplies or performance of services and there is no time to advertise by newspapers or circulars.

(2) When the prices of articles are fixed and uniform and no competition can be had.

(3) When bids have been invited and none have been received.

(4) When all bids received are above the market price or otherwise unreasonable.

IV. No purchase or agreement may be made under the provisions of the preceding Paragraph III unless the officer making it has previously informed himself concerning prevailing prices by inquiry among reputable dealers.

19. All purchases of supplies or agreements for employment which involve amounts under $250 may be made without advertisement and in any of the forms mentioned in paragraph 16, as may be to the best interests of the municipality, by the property clerk of the appropriate department as prescribed in this law: *Provided, however*, That any agreement thus made shall not extend for more than sixty days from the date when it was made, unless the articles are to be brought from abroad.

20. When any contract is made in any form, the municipal officer who makes it shall inform the municipal treasurer of the amount payable thereunder, and the name of the contractor, and to what appropriation it is chargeable.

21. No contracts may be made with any of the following:

(1) Those who, under the civil laws, lack the capacity to contract without the intervention of another person.

Digitized by Google

(2) Those who have been sentenced to imprisonment in a criminal case.

(3) Those who are bankrupt or are under legal suspension of payment, or whose property is attached.

(4) Those who are debtors to the state or to any province or ayuntamiento by virtue of any judicial order or judgment.

(5) Those who are declared failing bidders, or contractors, by the contract board because of failure to carry out an accepted bid or to properly perform previous contracts.

22. When a contract of any class is made for the performance of any work or service for the municipality within the period of one year, said performance may be extended by the contract board for a period not exceeding six months.

When a contract of any class is made for the performance of any work or services for the municipality within the period of more than one year, said performance may be extended by the municipal council for a period not exceeding one year.

23. When, after bids have been received therefor, the contract board shall determine that it is not practicable or advisable to make contracts for any public improvement for which an appropriation has been made, it may authorize such work to be done by the chief engineer: *Provided, however*, That if the estimated expense of said improvement shall amount to $25,000 or more the contract board shall report thereon to the municipal council, which alone may authorize the chief engineer to carry it out.

24. No contract under which the municipality must pay $3,000 or more shall be executed unless the contractor shall give bond for the full performance thereof.

A bond may or may not be required in either of the following cases:

(1) When the amount to be paid by the municipality is less than $250.

(2) When the amount is over $250 and under $3,000 and the contract is to be completed within thirty days from the date when it became binding on the municipality.

25. When a formal contract is made by the municipality the amount of the bond shall be determined by the contract board; in all other cases by the municipal officers authorized to make the contract.

26. When a bond is required from a contractor it shall not be less than one-tenth nor more than the total of the amount which the municipality is to pay him.

Every contractor's bond shall include a condition that he will promptly make payments to all persons who supply him with labor or materials for the prosecution of the work contracted for. Cash, certified checks, or bonds, as specified in paragraph 27, may be accepted as a contractor's bond subject to the above conditions.

27. Each bid shall contain the full name of every person or corporation interested in the same and shall be accompanied by a certificate that the bidder has deposited with the municipal treasurer cash equal to at least 5 per cent of the bid that he will enter into the contract if such bid is accepted. Such deposit may also be made in bonds of the city of Habana or of the United States, at value as ascertained as in paragraph 9. A certified check on a reputable bank of Habana may be accepted as guaranty.

If the bidder to whom the contract is awarded shall fail or neglect to enter into the contract or to file any further security that may be required within the time set out in the conditions and specifications upon which said contract was based, the mayor's secretary shall notify the municipal treasurer thereof, and the latter shall immediately put such cash or bonds deposited among the municipality's general funds. Under no circumstances shall such cash or bonds be returned to the failing bidder.

28. The contract shall be made in the name of the municipality. The municipality shall pay the contract price for the work in cash: *Provided, however*, That the contract for any improvement, for the payment of the cost of which a special assessment is authorized by law, may be paid in installments, as the council may have previously determined.

If two or more bids are equal for the whole or any part of the work, but are lower than any others, either may be accepted, but in no case shall the work be divided between them.

When there is reason to believe that there is collusion or combination among the bidders or any of them, the bids of those concerned therein shall be rejected.

In case of emergency and upon the recommendation of the mayor, the council may, by special ordinance in each case, authorize any expenditure not exceeding $10,000 without complying with the provisions of this law.

29. No contract for work to be done for or material to be supplied to the municipality or any department thereof shall be made with any councilman, officer, or employee of the municipality, or with any firm, partnership, or association of which such councilman, officer, or employee is a member, or with any corporation of which he is an officer or by which he is employed in any capacity. If any councilman, officer, or employee during the term for which he shall have been elected or appointed acquire an interest in any municipal contract, he shall forfeit his office.

Digitized by Google

30. Any officer of the municipality who shall aid or assist a bidder in securing a contract to furnish labor, material, or supplies at a higher price or rate than that proposed by any other bidder, except in making an award as prescribed in paragraphs 17, 18, and 19, or who shall favor one bidder over another by giving or withholding information, or who shall willfully mislead any bidder in regard to the character of the material or supplies called for, or who shall knowingly accept material or supplies of a quality inferior to that called for by the contract, or who shall knowingly certify to a greater amount of labor performed than has been actually performed, or to the receipt of a greater amount or different kinds of material or supplies than has been actually received, shall be deemed guilty of misfeasance and shall be removed from office.

31. The municipality's copy of all contracts signed shall be kept by the secretary of the contract board, who shall keep an accurate and detailed register of them. This register shall be open to the public inspection, and contracts so registered shall be considered public contracts in all respects as contemplated by the notarial law.

32. Advertisements, specifications, contracts, and bonds for formal contracts shall be in the forms prescribed by the contract board, which forms shall be as nearly as practicable the same as those prescribed for public works of the state.

33. In any case not provided for in this law the proceedings shall be similar to those prescribed for public works of the state.

NOTE.—The military governor deemed it best not to make any changes in the old Spanish laws on this subject at this time, and simply prescribed that the contract for paving and sewering Habana should be made in general accordance with the new law of state public works.

[Inclosure "B."]

ADVERTISEMENT, INSTRUCTIONS, SPECIFICATIONS, AND PROPOSAL FOR SEWERAGE SYSTEM AND STREET PAVING, CITY OF HABANA, CUBA.

NOTICE.

HABANA, *March 21, 1901.*

Owing to delay by city council in arranging for a loan, the date of opening proposals for sewering and paving Habana is postponed from April 3, 1901, to May 29, 1901, on which date proposals will be opened in accordance with the terms of advertisement, instructions, and general and special conditions dated Habana, Cuba, February 23, 1901.

ALEJANDRO RODRIGUEZ, *Mayor.*

ADVERTISEMENT.

OFFICE OF MAYOR, CITY OF HABANA.

HABANA, CUBA, *February 23, 1901.*

Sealed proposals for sewerage system and street paving, city of Habana, will be received at this office until 12 o'clock noon, April 3, 1901, and then publicly opened.

Information furnished on application to Lieut. W. J. Barden, Corps of Engineers, U. S. A., chief engineer, city of Habana.

ALEJANDRO RODRIGUEZ, *Mayor.*

SPECIFICATIONS.

GENERAL INSTRUCTIONS FOR BIDDERS AND GENERAL CONDITIONS.

1. Preference will be given to articles or materials of domestic production, conditions of quality and price being equal, including in the price of foreign articles the duty thereon.

2. Plans and maps of the localities may be seen at the office of the chief engineer. Bidders, all interested parties, or their authorized agents, are expected to visit the place and to make their own estimates of the facilities and difficulties attending the

Digitized by Google

execution of the work, including the uncertainty of the weather and all other contingencies. The work called for in these specifications will not be divided, but will be embraced in one contract.

3. All bids must be made in triplicate, upon printed forms to be obtained at the office of the chief engineer.

4. The guaranty to the proposal will be five hundred thousand dollars ($500,000.00) U. S. currency, in amount, to be deposited in U. S. currency bonds of the United States of America or bonds of the city of Havana, with the treasurer of the city of Havana, at least twenty-four hours before the time set for opening proposals. If bonds are deposited their value will be determined by their average market value during the month preceding the proposal in the Stock Exchange of Havana, as determined by the said city treasurer.

5. No proposal will be considered unless accompanied by a certificate of deposit of five hundred thousand dollars ($500,000.00) from the city treasurer of Havana, as a guaranty that if his bid for paving and sewering the city of Havana, under the proposals called for in this advertisement, be accepted within sixty days from date of the opening of the proposals therefor, the depositor will, within fifteen days after written notice of such acceptance, enter into a contract with the city of Havana to furnish the labor and materials and perform the work called for in these specifications, at the prices offered in his bid, and in accordance with the terms and conditions of these specifications, and give security as required therein for the faithful and proper fulfillment of such contract. And further, that in case he (the depositor) shall fail to enter into such contract and give such security within the said fifteen days after said notice of acceptance, the difference in money between the bid of said depositor for the said work, and the amount for which the mayor of Havana may contract with another party to furnish said labor and materials and to do said work, if the latter amount be in excess of the former, shall be forfeited to the city of Havana. The remainder shall be returned to the depositor.

6. When a contract has been entered into for the work specified within and the security furnished, the mayor will notify the city treasurer of that fact, who will thereupon return to the unsuccessful bidders their deposits, subject to the provisions of paragraph 5 above.

7. All signatures to proposals and contracts should be written out in full, and each signature to contracts should be attested by at least one witness, and when practicable, by a separate witness to each signature.

8. A proposal by a person who affixes to his signature the word "president," "secretary," "agent," or other designation without disclosing his principal, is the proposal of the individual. That by a corporation should be signed with the name of the corporation followed by the signature of the president, secretary, or other person authorized to bind it in the matter, who should file evidence of his authority to do so. That by a firm should be signed with the firm name either by a member thereof or by its agent, giving the names of all members of the firm. Anyone signing the proposal as the agent of another or others, must file with it legal evidence of his authority to do so.

9. The place of residence of every bidder, and post-office address, with county and state, or province, must be given after his signature.

10. All prices must be in United States currency and must be written as well as expressed in figures.

11. One copy each of the advertisement, the instructions for bidders, and the specifications, all of which can be obtained at this office on application by mail or in person, must be securely attached to each copy of the proposal and be considered as comprising a part of it.

12. Proposals must be prepared without assistance from any person employed in or belonging to the United States military government of the island of Cuba, or employed under this office.

13. No bidder will be informed, directly or indirectly, of the name of any person intending to bid or not to bid, or to whom information in respect to proposals may have been given.

14. All blank spaces in the proposal must be filled in, and no change shall be made in the phraseology of the proposal, or addition to the items mentioned therein. Any conditions, limitations, or provisos attached to proposals will be liable to render them informal and cause their rejection.

15. Alterations by erasure or interlineation must be explained or noted in the proposal over the signature of the bidder.

16. If the bidder wishes to withdraw his proposal he may do so before the time fixed for the opening, without prejudice to himself, by communicating his purpose in writing to the mayor of the city of Havana, and, when reached, it shall be handed to him or his authorized agent, unread.

Digitized by Google

17. Reasonable grounds for supposing that any bidder is interested in more than one bid for the same item will cause the rejection of all bids in which he is interested.

18. No bids received after the time set for opening of proposals will be considered.

19. The proposals, accompanied by the certificate of deposit called for in paragraph 5, must be placed in a sealed envelope, marked "Proposals for Sewage System and Street Paving for the City of Havana, to be opened April 3, 1901," and enclosed in another sealed envelope addressed to the Mayor, city of Havana, Havana, Cuba, but otherwise unmarked. It is suggested that the inner envelope be sealed with sealing wax.

20. At the date and hour set the proposals will be opened by the mayor in the order in which they may have been received by him. They will be read aloud when opened and the amount of each bid shall be recorded by his secretary. They will then immediately be sent to the chief engineer of the city, who will prepare an abstract of the bids and a report with recommendations as to their acceptance. This report, which must be rendered within three days after the proposals are opened, will be submitted to the council for their action, which must be taken within six days after the date of opening the proposals. The record of the action of the council with all the papers of the case will then immediately be forwarded by the mayor, with his recommendations, to the military governor, who will take final action on the award. Should the council not take action within the time fixed above, the mayor will forward all the papers, together with his recommendations, to the military governor, who will make the award. A member of the council, named previously by the council, and the chief engineer of the city should also be present at the opening of the proposals. All bidders are also invited to be present.

21. The contractors shall, for the price or prices bid, do all the work prescribed in these specifications, and shall keep all new work in repair for a term of five years from the date of its acceptance as prescribed in paragraph 27, except the pumping machinery, for which the term shall be one year from the date of acceptance for operation; make the requisite excavations for building the sewers and their appertaining structures and connections; shall do all ditching, diking, pumping, bailing and draining, all sheeting and shoring; shall make all provisions necessary to maintain and protect buildings, fences, trees, gas pipes, water pipes, water courses, conduits, culverts, sewers, railways, electric lines, and other structures, and shall repair all damages occasioned; shall provids all bridges, fences or other means of maintaining travel on intercepted streets, roads, and railroads, and on streets or roads in which the trenches are excavated, after giving due notice to parties affected thereby; shall maintain the same in good and safe condition so long as may be necessary, and then shall remove such temporary expedients and restore such ways to their proper conditions; shall provide watchmen, red lights, fences, and all other precautionary measures necessary to the protection of persons and property; shall provide all centers, molds, and forms; shall construct all foundations, all brick, concrete, stone, and timber work; shall set in place all iron work, and refill all trenches; shall erect and equip all buildings and machinery, shall do all grading, prepare all foundations, lay all paving and curbing; shall furnish all materials and all tools, implements, labor, and transportation required to build and put the sewerage system in complete working order, and to pave the streets; and shall do each and all to the satisfaction of the chief engineer. Land required for pumping stations or buildings of any class called for, and rights of way for sewers and drains, will be secured by the city of Havana without cost to the contractor.

Gas pipes which are leaky or too rotten to be removed without breaking will be replaced by the gas company. Leaky and rotten water pipes will be replaced by the city. The decision as to the good or bad condition of the pipes will rest with the chief engineer.

Within ten days after the contract has been approved, the contractor will deposit with the treasurer of the island of Cuba the sum of two hundred and fifty thousand dollars ($250,000.00) U. S. currency, as reimbursement to the island of Cuba for expense incurred in connection with the contract for sewering and paving the city of Havana. The treasurer of the island will furnish a proper receipt, therefor, and will notify the mayor of the city to that effect. The mayor will then notify the city treasurer, who will make no payment under the contract until such notification has been received by him.

22. The right is reserved to reject any and all bids, and to waive any informality in the bids received; also to disregard the bid of any failing bidder or contractor known as such to the government of the city of Havana.

23. The bidder to whom award is made will be required to enter into written contract with the city of Havana, with security, in an amount of one million dollars

Digitized by Google

($1,000,000.00) U. S. currency, guaranteeing that the contract will be faithfully performed; that the contractor or contractors will keep new works in repair for a period of five years from the date of acceptance, as provided for in paragraph 27, with the exception stated in paragraph 21, and be responsible for all damages to persons or property resulting from the works.

24. The security called for in paragraph 23 shall be a deposit of U. S. currency, bonds of the United States, or bonds of the city of Havana, or of all of these, to the amount of one million dollars ($1,000,000.00) U. S. currency, made by the contractor with the city treasurer, who shall issue a receipt therefor. If bonds are deposited their value shall be computed as described in paragraph 4. When the said contractor shall have in all respects duly and fully observed and performed all and singular of the covenants, conditions, and agreements in and by the contract agreed and covenanted, under these specifications, according to the true intent and meaning of said contract, and as well during any period of extension of said contract which may be duly granted him, as during the original term of the same, and shall have made full payment to all persons supplying him labor or materials in the prosecution of the work provided for in the contract, the said deposit shall be returned to him by the city treasurer with any accrued interest which may have been collected by the city, otherwise to be forfeited to the city of Havana. It shall be the duty of the mayor of Havana to notify the city treasurer of such fulfillment or nonfulfillment of the contract.

25. The contract which the bidder and grantor promise to enter into shall be, in its general provisions, in the form adopted and in use by the U. S. military government of the island of Cuba, blank forms of which can be inspected at this office and will be furnished, if desired, to parties proposing to put in bids. Parties making bids are to be understood as accepting the terms and conditions contained in such form of contract. The contract will be signed by the mayor for and in behalf of the city of Havana, and will be subject to the approval of the military governor of the island of Cuba.

26. Payments will be made monthly by the treasurer of the city of Havana on estimates made by the chief engineer, reserving ten (10) per cent from each payment, which will be retained as an additional security and guaranty fund to keep the works in repair for a term of five years from the date of acceptance, as provided for in paragraph 27, with the exception stated in paragraph 21. This retained fund, in cash, or bonds of the city of Havana or of the United States, will be deposited with the treasurer of the island of Cuba, and will be subject to the control of the governor-general of the island of Cuba, the mayor of the city of Havana, and the chief engineer of said city, acting as a commission, to be used for the purpose of maintaining the works in repair and in making good defects discovered during the period specified in case such repairs are not made by the contractor, and at the end of the specified period the amount of the fund remaining in the hands of the treasurer, with interest at the rate of four (4) per cent per annum, will be paid to the contractor or contractors on the certificate of the said commission that the money is thus due and payable.

27. The sewer work will be provisionally accepted by the chief engineer of the city, by sections as named in the proposal. Pavements will be accepted by streets. It will be the duty of the chief engineer to notify the mayor of the date of acceptance of each part of the work, who will in turn notify the city treasurer. The term of five years for keeping the works in repair will begin for each part on the date of acceptance, as above provided for.

28. A copy of this advertisement, specifications, instructions, and form of proposal will be attached to the contract and form a part of it.

29. The contractor should, within ten days from the award of the contract, furnish this office with the post-office address to which communications should be sent.

30. Transfer of contracts, or of interest in contracts, is prohibited by law.

31. The contractor will not be allowed to take advantage of any error or omission in these specifications, as full instructions will always be given should such error or omission be discovered.

32. It is understood and agreed that the quantities given are approximate only, and it must be understood that no claim shall be made against the city of Havana on account of any excess or deficiency, absolute or relative, in the same. Bidders are expected to examine the drawings, and are invited to make the estimate of quantities for themselves.

33. The decision of the chief engineer in charge upon any doubt as to the meaning of these specifications, and upon all questions arising under them, shall be final.

34. Should the time for the completion of the contract be extended, all expenses for inspection and superintendence during the period of extension, the same to be

Digitized by Google

determined by the chief engineer of the city of Havana, shall be deducted from payments due or to become due to the contractor: *Provided, however*, That if the party of the first part shall, in the exercise of his discretion, on account of quarantine restrictions, freshets, or other force or violence of the elements, allow the contractor additional time in writing, as provided for in the form of contract, there shall be no deduction for the expenses for inspection and superintendence for such additional time so allowed: *Provided further*, That nothing in these specifications shall affect the power of the party of the first part to annul the contract, as provided for in the form of contract adopted and in use by the U. S. military government of the island of Cuba.

35. The contractor will be required to hold the city of Havana harmless against all claims for the use of any patented article, process, or appliance in connection with the contract herein contemplated.

36. The contractor will be required to commence the work within thirty (30) days after receiving notice of approval of contract, and must complete the entire contract within four years from date of receipt of such notification. The work shall be prosecuted in such manner, and from as many different points, and at such times and with such force as the chief engineer may, from time to time during the progress of the work, determine. Should the rate of progress made be unsatisfactory, of which the chief engineer shall be the judge, the contractor will be required to satisfactorily increase his force without delay; and in case of his failure to do this, the right is reserved to take the work out of his hands and to complete the same by hired labor and purchase in open market, deducting the excess of cost, if any, above the contract, from any money due or to become due the contractor.

At least seventy-five (75) per cent of the unskilled laborers and employees (not technical) shall be inhabitants of the island of Cuba; and in case of a general strike the contractor and mayor shall appoint arbitrators to settle it. But in case of failure to settle the strike within twenty-four hours, the contractors shall be allowed to employ any labor available within the island.

37. Inspectors shall be appointed by the chief engineer of the city of Havana, subject to the orders of superior executive authority, who shall have access to all parts of the work at all times, and whose duty it shall be to point out to the contractor any neglect or disregard of the specifications or contract, or defective material or work, but the right of final rejection of the work will not be waived at any time.

Upon all technical questions concerning the execution of the work in accordance with the specifications, and upon the quality or quantity thereof, the decision of the chief engineer shall be final.

38. Defective work, whether passed upon or not by the inspector, must be immediately taken down upon notice of condemnation by the chief engineer, and such work must be rebuilt. Defective material will be condemned by the chief engineer, and when so condemned must be removed from the line of work and disposed of to his satisfaction. In case the contractor neglects or refuses to take down or replace any defective work or remove any defective material within the time designated by the chief engineer, such work or material shall be removed or replaced by the chief engineer and the expense thereof charged against the contractor.

39. At all times when the work is in progress there shall be a foreman, or other representative of the contractor, and a copy of the plans and specifications on the grounds. Instructions given to such foreman or other representative will be considered as given to the contractor.

40. Any incompetent, insubordinate, disorderly, or objectionable employee of the contractor shall be discharged, if required by the chief engineer, and shall not again be employed in the work without his permission.

41. Work on Sundays, legal holidays, or at night will be carried on whenever so ordered in writing by the chief engineer of the city, or whenever he gives a written permit therefor, with the visto bueno of the mayor.

42. Any assistance or material required by the representative of the chief engineer in giving lines and grades and in making any necessary measurements shall be furnished by the contractor without expense to the city. Benchmarks and grade or line stakes or marks must be carefully preserved by the contractor, and if destroyed after they have been placed the cost of renewing them shall be a charge against the contractor.

43. Whenever the words "engineer" or "chief engineer" are used in these specifications they are understood to designate the chief engineer of the city of Havana.

44. The contractor will punctually pay the workmen who shall be employed by him upon the work under his contract in United States currency, and will, from time to time, and as often as may be required by the chief engineer, furnish satisfactory

Digitized by Google

evidence that all persons who have done work or furnished materials have been paid as herein required; and if such evidence is not furnished, such sum or sums as may be necessary for each payment may be retained from any money due or to become due the contractor, in addition to the retained percentages from such monthly payments provided for herein, until such claims shall be fully justified.

45. The contractor must be prepared to do any extra work that may be ordered in writing by the chief engineer, and for this he will be paid at the contract rates for work of a similar character, or, if the extra work should be of a class for which no rate is fixed by the contract, the actual reasonable cost to the contractor, as determined by the chief engineer, plus fifteen (15) per cent of said cost.

The contractor shall have no claim for compensation for extra work unless the same is ordered in writing by the chief engineer, and unless the claim for the same, when so ordered, is presented to the chief engineer before the first day of the month following that during which each specific order is complied with. In this connection attention is invited to the provisions concerning extra work, embodied in the standard form of contract in use by the U. S. military government of the island of Cuba.

46. Any modification of the plans or specifications, or of the prescribed lines, grades, positions, methods, or materials of construction, which, in the judgment of the chief engineer, may be considered expedient, shall be made by the contractor, and any changes in the quantities of materials or labor thereby involved shall be allowed for at the contract rates allowed for extra work for any increase and the same rate for deductions for any decrease in any such quantities. No consequential loss of profit to the contractor for work not executed will be allowed.

47. The surveys, maps, and plans as furnished by the chief engineer are not guaranteed to be exact. Should there be any discrepancy between figures and scaled distances the figures shall rule.

48. The contractor shall restore any street, sidewalk, or cross walk, or any other surface which may be disturbed in the prosecution of the work, to as good condition as it was at the time of the commencement of the work, and if such restoration is not made within a reasonable time after the completion of the work, the chief engineer will give notice in writing that such restorations must be made within fifteen days or the work necessary will be done by the city and the expense thereof charged to the contractor.

49. The chief engineer shall have the right to correct any errors or omissions in the plans and specifications, when such corrections are necessary to the proper fulfillment of the intentions of the plans and specifications, and the contractor shall conform to the same without extra charge.

50. On five days' notice the work under this contract may, without cost or claims against the city of Habana, be suspended for want of funds, epidemics of disease, or other necessary cause; provided that work shall not be stopped on account of epidemics, except upon order of the governor of the island. The work must be left in such sanitary condition as the chief engineer may order. When the chief engineer shall order the work resumed, the contractor will complete the same upon the terms and conditions of the contract.

51. The detailed plans are to be considered a part of the specifications.

52. The contractor shall be obliged to indemnify property owners for all physical injury which may be caused by the execution of the sewer works through negligence, carelessness, or unskillfulness.

53. The contractor shall insure the lives of the workmen against all accidents which may be caused by the works in accordance with the royal decree of June 11, 1886.

54. The contractor will be required to repave all cuts in the street pavements laid by him which are made by proper authority during and after the completion of all work under this contract and during the period embraced in the guarantee, and shall be paid therefor at the prices originally paid for the same work under the contract, except for brick pavement, for which the price per square meter shall be $1 less than that originally paid. The guarantee for such repaving shall expire at the same time as that for the original paving on the street in which said repaving is done.

Digitized by Google

Special Conditions.

SEWERAGE SYSTEM.

1. Description of work to be done.—The work to be done under this contract comprises the furnishing of all labor and materials necessary for the construction of a sewerage and drainage system for the city of Habana, according to the plans and specifications.

The work will be divided as follows:

East side marginal system.

Section 1. Approximately bounded by the harbor, Zulueta, and Empedrado streets.

	Meters.		Meters.
8-inch sewer	4,381	24-inch drain	689
10-inch sewer	752	28-inch drain	98
12-inch sewer	55	32-inch drain	506
48-inch sewer	497	34-inch drain	360
54-inch sewer	131	36-inch drain	73
18-inch drain	457	38-inch drain	73
20-inch drain	259		

Section 2. Approximately bounded by Monserrate, Amargura, Cuba, and Empedrado streets.

	Meters.		Meters.
8-inch sewer	4,596	20-inch drain	219
10-inch sewer	790	24-inch drain	567
12-inch sewer	85	26-inch drain	97
18-inch sewer	80	30-inch drain	792
20-inch sewer	250	36-inch drain	165
24-inch sewer	164	40-inch drain	165
12-inch drain	43	44-inch drain	152
18-inch drain	549	50-inch drain	158

Section 3. Approximately bounded by Amargura, Prado, Sol, and Aguacate streets.

	Meters.		Meters.
8-inch sewer	3,944	18-inch drain	296
10-inch sewer	370	20-inch drain	612
12-inch sewer	291	24-inch drain	216
15-inch sewer	443	26-inch drain	271
12-inch drain	372	28-inch drain	95
15-inch drain	317		

Section 4. Approximately bounded by Sol, Someruelos, Merced, and Damas streets.

	Meters.		Meters.
8-inch sewer	3,542	20-inch drain	120
10-inch sewer	436	24-inch drain	240
12-inch sewer	95	26-inch drain	90
15-inch sewer	345	30-inch drain	355
12-inch drain	555	36-inch drain	215
15-inch drain	295	38-inch drain	525
18-inch drain	270	42-inch drain	75

Section 5. Approximately bounded by the harbor, Acosta, Damas, Merced, and Egido streets.

	Meters.		Meters.
8-inch sewer	4,770	18-inch drain	230
10-inch sewer	190	20-inch drain	510
12-inch sewer	70	24-inch drain	225
18-inch sewer	530	28-inch drain	235
20-inch sewer	565	32-inch drain	335
12-inch drain	220	42-inch drain	300
15-inch drain	400	44-inch drain	60

Section 6. Approximately bounded by the harbor, Acosta, Cuba, Sol, Aguacate, and Amargura streets.

	Meters.		Meters.
8-inch sewer	4,345	24-inch drain	185
10-inch sewer	380	26-inch drain	95
12-inch sewer	450	28-inch drain	95
15-inch sewer	420	30-inch drain	110
28-inch sewer	135	34-inch drain	385
32-inch sewer	325	36-inch drain	170
34-inch sewer	45	38-inch drain	155
12-inch drain	50	40-inch drain	165
15-inch drain	385	42-inch drain	105
18-inch drain	210	56-inch drain	55
20-inch drain	105		

Digitized by Google

SECTION 7. Approximately bounded by the harbor, Amargura, Cuba, and Empedrado streets.

	Meters.		Meters.
8-inch sewer	3,545	28-inch drain	100
12-inch sewer	195	30-inch drain	70
38-inch sewer	125	32-inch drain	80
40-inch sewer, and modified section	535	36-inch drain	75
44-inch sewer	68	50-inch drain	30
46-inch sewer	127	56-inch drain	115
12-inch drain	60	58-inch drain	160
15-inch drain	90	62-inch drain	130
18-inch drain	250	64-inch drain	365
20-inch drain	185	66-inch drain, and modified section	45
24-inch drain	325		

North side marginal system.

SECTION 1. Approximately bounded by the sea, Zulueta, Neptuno, Prado, Dragones, and Industria streets.

	Meters.		Meters.
8-inch sewer	6,830	24-inch drain	850
10-inch sewer	1,245	26-inch drain	115
12-inch sewer	245	28-inch drain	320
15-inch sewer	215	32-inch drain	105
32-inch sewer	455	38-inch drain	245
34-inch sewer	296	40-inch drain	115
114-inch sewer	120	50-inch drain	90
12-inch drain	460	54-inch drain	70
15-inch drain	495	56-inch drain	110
18-inch drain	670	60-inch drain	150
20-inch drain	325		

SECTION 2. Approximately bounded by the sea, Industria, Reina, and San Nicolas streets.

	Meters.		Meters.
8-inch sewer	6,445	32-inch drain	80
10-inch sewer	725	34-inch drain	200
12-inch sewer	110	36-inch drain	115
15-inch sewer	560	38-inch drain	75
32-inch sewer	340	44-inch drain	90
12-inch drain	375	46-inch drain	80
15-inch drain	180	50-inch drain	55
18-inch drain	580	56-inch drain	80
20-inch drain	660	62-inch drain	75
24-inch drain	490	66-inch drain	195
26-inch drain	280	68-inch drain	95
28-inch drain	105	78-inch drain	185

SECTION 3. Approximately bounded by the sea, San Nicolas, Salud, Lealtad, and Perseverancia streets.

	Meters.		Meters.
8-inch sewer	4,235	24-inch drain	610
10-inch sewer	900	26-inch drain	75
12-inch sewer	320	30-inch drain	290
30-inch sewer	215	32-inch drain	175
32-inch sewer	105	40-inch drain	130
15-inch drain	75	42-inch drain	75
18-inch drain	775	50-inch drain	60
20-inch drain	140	52-inch drain	115

SECTION 4. Approximately bounded by the sea, Perseverancia, Lealtad, Reina, and Belascoain streets.

	Meters.		Meters.
8-inch sewer	6,045	26-inch drain	145
10-inch sewer	790	28-inch drain	230
12-inch sewer	560	30-inch drain	230
15-inch sewer	245	34-inch drain	160
30-inch sewer	400	36-inch drain	160
12-inch drain	140	40-inch drain	165
15-inch drain	170	42-inch drain	80
18-inch drain	640	44-inch drain	185
20-inch drain	665	48-inch drain	110
24-inch drain	445		

Digitized by Google

SECTION 5. Approximately bounded by the sea, Belascoain, Reina, and Soledad streets.

	Meters.		Meters.
8-inch sewer	6,400	26-inch drain	30
10-inch sewer	1,275	30-inch drain	65
12-inch sewer	110	32-inch drain	115
15-inch sewer	300	34-inch drain	75
18-inch sewer	130	36-inch drain	340
78-inch sewer	340	42-inch drain	400
12-inch drain	75	44-inch drain	300
15-inch drain	525	54-inch drain	130
18-inch drain	595	58-inch drain	45
20-inch drain	430	60-inch drain	90
24-inch drain	165		

SECTION 6. Approximately bounded by the sea, Soledad, Reina, and Infanta streets.

	Meters.		Meters.
8-inch sewer	5,885	15-inch drain	560
10-inch sewer	1,135	18-inch drain	575
12-inch sewer	170	20-inch drain	340
15-inch sewer	700	24-inch drain	380
18-inch sewer	265	26-inch drain	825
20-inch sewer	85	28-inch drain	345
56-inch sewer	380	30-inch drain	380
58-inch sewer	340	32-inch drain	160
70-inch sewer tunnel	700	36-inch drain	220
74-inch sewer	330	42-inch drain	255
12-inch drain	395	48-inch drain	115

South side high level system.

SECTION 1. Approximately bounded by Reina, Escobar, Valla, Manrique, Sitios, and Angeles streets.

	Meters.		Meters.
8-inch sewer	5,295	15-inch drain	250
10-inch sewer	80	18-inch drain	310
12-inch sewer	80	20-inch drain	410
18-inch sewer	255	25-inch drain	170
20-inch sewer	80	26-inch drain	565
24-inch sewer	100	28-inch drain	190

SECTION 2. Approximately bounded by Reina, Santa Rosalia, Benjumeda, and Escobar streets.

	Meters.		Meters.
8-inch sewer	4,075	18-inch drain	225
10-inch sewer	390	20-inch drain	270
64-inch sewer	590	24-inch drain	310
12-inch drain	130	26-inch drain	365
15-inch drain	145	28-inch drain	190

SECTION 3. Approximately bounded by Reina, Infanta, Aramburu, Penalver, and Santa Rosalia streets.

	Meters.		Meters.
8-inch sewer	4,050	15-inch drain	815
10-inch sewer	830	18-inch drain	400
15-inch sewer	310	20-inch drain	75
20-inch sewer	275	24-inch drain	90
24-inch sewer	80	28-inch drain	60
64-inch sewer	255	30-inch drain	160
66-inch sewer	310	32-inch drain	260
70-inch sewer tunnel	365	34-inch drain	250
70-inch sewer	395	42-inch drain	80
74-inch sewer	435	44-inch drain	175
12-inch drain	820		

North Matadero system.

SECTION 1. Approximately bounded by the harbor, Revillagigedo, Corrales, and Someruelos streets.

	Meters.		Meters.
8-inch sewer	4,510	18-inch drain	325
10-inch sewer	245	20-inch drain	205
12-inch sewer	170	24-inch drain	520
20-inch sewer	145	28-inch drain	150
24-inch sewer	105	30-inch drain	400
26-inch sewer	345	50-inch drain	105
12-inch drain	420	52-inch drain	75
15-inch drain	430		

Digitized by Google

SECTION 2. Approximately bounded by the harbor, Anton Recio, Sitios, Monte, and Revillagigedo streets.

	Meters.		Meters.
8-inch sewer	5,415	28-inch drain	205
10-inch sewer	135	32-inch drain	295
12-inch sewer	285	36-inch drain	70
15-inch sewer	290	38-inch drain	170
24-inch sewer	130	40-inch drain	35
26-inch sewer	380	50-inch drain	45
12-inch drain	80	58-inch drain	130
15-inch drain	410	72-inch drain	90
18-inch drain	130	80-inch drain	80
20-inch drain	885	82-inch drain	180
24-inch drain	545	84-inch drain	60

SECTION 3. Approximately bounded by Matadero Creek, Belascoain, Carmen, Manrique, and Anton Recio streets.

	Meters.		Meters.
8-inch sewer	3,905	20-inch drain	90
10-inch sewer	145	24-inch drain	245
12-inch sewer	215	26-inch drain	235
26-inch sewer	90	28-inch drain	245
28-inch sewer	80	32-inch drain	110
30-inch sewer	160	38-inch drain	530
34-inch sewer	205	40-inch drain	170
12-inch drain	50	42-inch drain	145
15-inch drain	60	50-inch drain	50
18-inch drain	80		

Matadero drainage system.

Approximately bounded by Matadero Creek, Aramburu, Penalver, and Belascoain streets.

	Meters.		Meters.
24-inch drain	300	68-inch drain	80
32-inch drain	115	70-inch drain	180
34-inch drain	300	82-inch drain	175
42-inch drain	105	84-inch drain	130
46-inch drain	90	140-inch drain	90
48-inch drain	135	16 by 10 inch drain	270
50-inch drain	245	18 by 9½ inch drain	340
58-inch drain	330	20 by 9½ inch drain	825

South Matadero system.

SECTION 1. Approximately bounded by Matadero Creek, the harbor, Agua Dulce Creek, Carrillo, Clavel, and Fernandina streets.

	Meters.		Meters.
8-inch sewer	4,610	15-inch sewer	330
10-inch sewer	580	32-inch sewer	565
12-inch sewer	395	36-inch sewer	495

SECTION 2. Approximately bounded by the harbor, Agua Dulce Creek, San Benigno, Enamorado, and Santa Felicia streets.

	Meters.		Meters.
8-inch sewer	3,610	20-inch sewer	230
10-inch sewer	375	24-inch sewer	175
15-inch sewer	220	26-inch sewer	50
18-inch sewer	285		

Jesus del Monte system.

South of San Benigno, Enamorado, and Santa Felicia streets.

	Meters.		Meters.
8-inch sewer	7,905	24-inch sewer	105
10-inch sewer	255	26-inch sewer	120
12-inch sewer	340	34-inch sewer	120
15-inch sewer	760	38-inch sewer	730

Cerro system.

SECTION 1. Approximately bounded by Cerro, Fernandina, Clavel, and Carrillo streets.

	Meters.		Meters.
8-inch sewer	3,816	52-inch sewer	299
50-inch sewer	899		

Digitized by Google

SECTION 2. Approximately bounded by Matadero Creek, Fernandina, Cerro, and Saravia streets.

	Meters.		Meters.
8-inch sewer	5,968	52-inch sewer	505
10-inch sewer	259	54-inch sewer	90
28-inch sewer	780	62-inch sewer	105

SECTION 3. Approximately bounded by Carmen, Falgueras, Tulipan, Cerro, and Saravia streets.

	Meters.		Meters.
8-inch sewer	4,435	15-inch sewer	535
10 inch sewer	285	18-inch sewer	585
12-inch sewer	440		

SECTION 4. Approximately bounded by Carmen, Falgueras, Tulipan, Santo Tomas, and Paniagua streets.

	Meters.		Meters.
8-inch sewer	4,040	12-inch sewer	260
10-inch sewer	240	15-inch sewer	215

SECTION 5. Between Paniagua and Santo Tomas streets and the Western Railroad.

	Meters.		Meters.
8-inch sewer	1,695	15-inch sewer	550
10-inch sewer	75	18-inch sewer	730
12-inch sewer	75	20-inch sewer	110

Vedado system.

SECTION 1. South of Linea and 11th streets.

	Meters.		Meters.
8-inch sewer	5,000	26-inch sewer	475
10-inch sewer	2,000	28-inch sewer	860
12-inch sewer	1,000	44-inch sewer	630
15-inch sewer	500	54-inch sewer	350
18-inch sewer	250	56-inch sewer	530
20-inch sewer	250		

SECTION 2. North of Linea and 11th streets.

	Meters.		Meters.
8-inch sewer	9,000	20-inch sewer	750
10-inch sewer	2,500	26-inch sewer	710
12-inch sewer	1,500	28-inch sewer	240
15-inch sewer	1,000	32-inch sewer	600
18-inch sewer	1,440	36-inch sewer	650

Manholes: 1st class, 23; 2d class, 712; 3d class, 159; 4th class, 531; 5th class, 245; 6th class, 10. Receiving inlets, number 1, 1,400; number 2, 1,000; ventilators, 50,000 meters; outfalls, 24; house connections for sewers, vitrified pipe, 130,500 meters; house connections for sewers, cast-iron pipe, 50,000 meters; house connections for drains, 6,100 meters; inlet connections for drains, 12,000 meters; valves, three 36-inch valves, two 20-inch valves. Force mains: 36-inch force main, 451 meters; 20-inch force main, 310 meters. Infanta siphon; concha siphon; matadero siphon; south side pumping station; Vedado pumping station; Vedado sublift, cor. 5th and B sts.; Vedado sublift, cor. 7th and 16th sts.; sand catcher and settling basins; temporary pumping station and outfall at La Punta; siphon across Havana harbor, El Morro pumping station, outfall sewer, 7-foot diameter tunnel, 400 meters; 7-foot diameter sewer, 650 meters. Outfall well; offshore outfall.

As a basis for comparing bids, the following amounts of extra work will be assumed: Earth excavation, 20,000 cubic meters; rock excavation, 8,000 cubic meters; rubblestone masonry, 10,000 cubic meters; second-class concrete masonry, 10,000 cubic meters; extra haul, 20,000 cubic meters, one kilometer; old sewer deposits, 20,000 cubic meters; extra haul material from old sewers, 20,000 cubic meters, one kilometer; foundation timber, 600,000 ft. B. M; piles, 20,000 meters; sheathing left in trench, 100,000 ft. B. M; sheet piling left in place, 50,000 ft. B. M.

2. Excavation.—All excavation shall be by open cut from the surface, except when tunnelling is shown on the plans, or is specially permitted by the chief engineer. The trench shall be excavated along the line designated by the chief engineer, and to the depth necessary for laying the sewer or drain at the grade given by him. In the case of pipe sewers or drains, it shall be one foot wider at the bottom than the outside diameter of the pipe, and for brick or concrete sewers or drains, as wide as the greatest external horizontal width of the structure to be placed therein, without any undercutting of the banks. The trench at the top shall not extend laterally more than one-half meter beyond the outside of the sewer, unless by written permission of the chief engineer. Whenever the material is of such a nature as to allow it, the bottom of the excavation up to the greatest horizontal diameter of the proposed construction shall be made with a templete so as to conform to the exact shape of the proposed construction. For pipe drains, the bottom of the trench under each bell

Digitized by Google

shall be hollowed out so as to allow the body of the pipe to have a bearing throughout on the trench bottom and permit of making the joint. In case a trench be excavated at any place, excepting at joints, below the proper grade, it shall be refilled to grade with sand or loam, thoroughly rammed, without extra compensation, unless the extra excavation is ordered by the chief engineer. If the character of the ground met with is such that the external form of the construction can not be preserved, the excavation will be made to conform as nearly as possible to the external form of construction, and the space for a width equal to the greatest diameter of the construction between the bottom of the construction and the excavation must be filled with concrete in the case of a sewer, and with well-rammed sand or loam in the case of a drain, unless otherwise ordered by the chief engineer, and without extra compensation. Rock shall be excavated to conform as nearly as possible to the outlines of the proposed construction, and the space between the excavation and the bottom of the construction shall be filled as above. All excavation shall be completed at least 10 meters in advance of the sewer work.

The uncontaminated material excavated shall be laid compactly on the side of the trench, except where excavating machinery is used, and kept trimmed up so as to be of as little inconvenience as possible to the traveling public and the adjoining tenants. Where the street is paved, the paving shall be kept separate from the other material excavated.

All surplus material shall be removed from the trench and streets as fast as back fill is complete and must not be left on the side of the trenches. All such surplus material will be the property of the city of Havana and shall be conveyed by the contractor, without cost to the city, to such a place, not distant on the shortest practicable route more than one kilometer from the work, as the chief engineer may designate. For hauls greater than one kilometer extra payment will be made as provided for herein.

Where the trenches do not furnish sufficient material of proper quality for back filling the deficiency must be supplied by the contractor at his own expense.

No blasting shall be done, except with the written permission of the chief engineer. Where blasts are made the trench or other excavation is to be covered with suitable material to the satisfaction of the chief engineer. No blasting shall be done within forty feet of a finished sewer, and the end of the sewer must be covered or stopped with plank or earth during each blast. The contractor must store all dynamite or other explosives in a place satisfactory to the chief engineer, and the quantity of explosive stored at any one point at any one time must not exceed the amount specified for that point by the chief engineer. It is understood that the contractor is in all cases responsible for any damages caused by blasting or explosives.

Whenever it is necessary to intercept, work near, or in any way interfere with any public or house sewer, drain, gas or water pipe, catch-basin, culvert, or other similar structure, the contractor shall maintain the same in working order; and shall repair and make good any damage done to or by any of them during the progress of the work.

The sides of the excavation shall, whenever it may be necessary, be supported with suitable sheathing and shoring, and no allowance will be made therefor unless same is left in by written order of the chief engineer. When left in the trench, by order, the sheathing shall be cut off at a point not less than one foot below the surface. The contractor shall, at his own expense, shore up and otherwise protect all buildings or foundations or other structures which might be endangered by the work.

There will be two classes of excavation, earth and rock. Only such ledge rock as, in the opinion of the chief engineer, requires blasting for its removal, or bowlders of ½ cubic meter or more in volume which are removed from the trench will be estimated as rock excavation. All other excavation will be classed as earth excavation. Extra excavation only, either earth or rock, will be paid for. Only such excavation as is made necessary by change of plans and is in excess of that previously shown will be considered extra. The decision of the chief engineer as to the classification of excavation and as to the amount of extra excavation shall be final.

In all cases the sidewalks and street railways must be left unobstructed, and wherever practicable a roadway along the side of the street in which work is being carried on shall be maintained. All fire hydrants shall be left uncovered and accessible.

In no case shall any obstruction be placed in a cross street at a greater distance than fifteen meters from the nearest corner, and a roadway must be maintained two and three-tenths meters in width on such cross streets. Suitable bridges shall be provided over excavations for traffic at such cross streets and at such other places as may be ordered by the chief engineer. The contractor will not be allowed to obstruct adjacent blocks in parallel streets, nor to occupy more than one hundred linear

Digitized by Google

meters in the street in which work is being done, unless by written permission of the chief engineer. The contractor must provide for the safety of the public and provide all fences, supports for street railway and railroad tracks, red lights, watchmen, or other facilities as may be necessary, to the satisfaction of the chief engineer.

The contractor is to do all pumping and bailing, and to build all drains and temporary pipe or hose lines required to take care of all house drainage, sewage, seepage, or storm water on the line of the work, and must not allow any water to stand or run on new work until the cement mortar is so completely set as to be safe from injury. No stagnant water shall be allowed at any time to remain in any trench or excavation. All sewage is to be conveyed in pipe or hose lines and will not be allowed to run on the surface. He may, with the approval of the chief engineer, prevent water from flowing into manholes by erecting small dams in streets to divert storm water to other sewers, but will be responsible for all damage caused by such interruption or diversion of drainage. He shall at all times have upon the work sufficient plant of pumping machinery ready for immediate use.

Until the work under the sewer contract has been completed the sewage of the city must be cared for by the contractor at his own expense, and as follows: Prior to the completion of the Morro pumping station and of the outfall system, in measure as the sewer system is installed, the flow from the old mains and from house connections, as directed by the chief engineer, must be conveyed through the new sewers to the punta, and there disposed of as provided for in par. 40. As soon as the outfall system has been completed and accepted for operation, the sewage will be turned into it, and the Morro pumping station will be operated by the city. In like manner the south side pumping station and the Vedado pumping station and sublifts will be operated by the city as soon as they and the mains leading from them to the punta are completed.

Where water or gas pipes or electrical conduits must have their location changed on account of the sewer and its appurtenances, the contractor shall bear all expenses attending such changes. This includes all the work necessary to make such changes and to restore the street to its previous condition. When public lamps interfere with the location of receiving inlets they will be removed by the city. All gas and water pipes exposed by the work must be supported immediately prior to the refilling by suitable plank or scantling in such a manner as to prevent breakage or settling.

If new pavement in streets in which sewers and drains have been laid is not placed immediately after refilling the trench, the old paving will be replaced and maintained in good condition until the new is laid.

Deposits in old sewers, house drains, or catch-basins or other material that the chief engineer considers unsanitary, shall be, as soon as uncovered, treated with quicklime and conveyed by the contractor to the city garbage dump and there loaded on board such scows as the superintendent of garbage disposal may direct, or to such other place as the chief engineer may direct.

Such portions of the old sewers as the chief engineer may designate shall be cleaned, and the deposits disposed of as above, and the space filled with good clean sand or loam of a quality satisfactory to the chief engineer.

3. Tunnels.—Tunnels shall be built according to the plans. The allowable amount of excavation outside of the lines of the tunnel shall be fixed by the chief engineer, and all such excavations shall be filled with concrete masonry of the second class, unless otherwise ordered by the chief engineer. Should it appear at any time that the filling has not been properly made, the contractor shall be required, without charge, to make such openings through the tunnel as may be necessary, and completely fill all vacant spaces by pumping in a grout composed of mortar of the second class.

MATERIALS.

4. Bricks, common.—Bricks must be of the best quality for the purpose for which they are intended, uniform in quality, sound and burned hard entirely through, free from lime and cracks, whole, with true surfaces, and edges full and square, and of standard dimensions. After being thoroughly dried and immersed in water for 24 hours, they shall not absorb more than ten (10) per cent by weight of water. All bats and defective bricks will be rejected. They must have a crushing strength of not less than 4,500 lbs. per square inch. Samples will be subject to such other tests as the chief engineer may order, and they must be in all respects at least equal to the sample in the engineer department of the city of Havana.

5. Bricks, vitrified invert.—Vitrified invert bricks must possess such smoothness, hardness, toughness, and durability as will especially fit them for use in the inverts of sewers. They must be uniform in quality, sound and burned hard entirely through,

Digitized by Google

free from lime and cracks, whole, with true surfaces and edges full and square, and of standard dimensions (American). After being thoroughly dried and immersed in water for 24 hours, they shall not absorb more than 3 per centum of their weight of water. Samples will be subject to such other tests as the chief engineer may order. They must be in all respects at least equal to the sample in the engineer department of the city of Havana, and must be of a make satisfactory to the chief engineer.

6. Vitrified pipe.—All pipe and specials, unless otherwise specified, shall be salt glazed, vitrified clay sewer pipe, free from lumps or other imperfections, straight and with little variation from the true cylindrical shape. The inside and outside shall be concentric. It shall be of the bell and spigot pattern, and the pipes and specials must conform in all respects to the dimensions given on the detailed plans. All slant junctions and Y junctions must be molded to an angle of forty-five degrees with the sewer with which they are to connect. All pipes must not be less than 2½ feet in length. In the cross section of a pipe, the allowable variation between any two diameters shall not be more than one twenty-fourth of the nominal diameter. No pipe may vary more than three-eighths of an inch from a straight cylinder in its length.

A single longitudinal fire crack extending through the entire thickness of the pipe at the end can not be more than 2 inches long. Two or more such cracks at either end will be cause for rejection.

A fire crack extending through the entire thickness of a pipe at any other place in the pipe will be cause for rejection.

A fire crack extending through one-half the thickness of the pipe must not be over 6 inches long. Two or more such fire cracks at either end of the pipe or within 4 inches of each other will be cause for rejection.

A fire crack extending through less than one-half the thickness of the pipe must not be over 8 inches long, and two or more such fire cracks will be cause for rejection.

A transverse fire crack must not extend for more than one-tenth of the circumference of the pipe, nor may its depth be greater than one-third the thickness. No fire crack may be more than one-eighth of an inch wide at its widest point.

Any pipe which may otherwise be cracked through its whole thickness will be rejected.

Irregular lumps or unbroken blisters on the interior of the pipe sufficient to cause an appreciable obstruction to flow will be cause for rejection. If there is a broken blister or flake on the interior or exterior of a pipe or special, which is thicker than one-sixth the normal thickness and whose largest diameter is greater than one-twelfth the inner circumference of said pipe or special, such pipe or special will be rejected.

If a piece be broken out of the rim of a pipe or special, leaving a gap longer than one-twelfth the inner circumference of said pipe or special, the same will be rejected.

Any combination of the above defects of pipes or specials will be cause for rejection.

Pipes or specials having any of the above defects must be laid with such defect above the flow line in the sewer or such pipe will be rejected. Furthermore, such defect must be filled with cement mortar without sand.

7. Cement.—All cement will be inspected, and that rejected shall be immediately removed by the contractor, unless otherwise authorized in writing by the chief engineer. The contractor must submit the cement and afford every facility for inspection and testing, at least 30 days before it is used. The inspector of cement shall be notified at once upon the receipt of each shipment of cement upon the work.

No cement will be inspected or allowed to be used unless delivered in tight, paper-lined barrels, properly branded.

On all work that the chief engineer may designate, there shall be provided a suitable building for storing the cement.

Accepted cement, if not used immediately, must be thoroughly protected from the weather and never placed on the ground without proper blockings, and may be reinspected at any time.

The failure of a shipment of cement for any work to meet the requirements may prevent further use of the same brand.

The acceptance of any cement will rest with the chief engineer, and will be based upon the following requirements:

The cement must be of the best quality, fresh, dry, finely ground, and free from lumps.

It must stand the following tests:

At least 90% must pass a sieve of 100 meshes to the linear inch, the wire being No. 40 Stubbs wire gauge.

Digitized by Google

Neat cement briquettes, made according to American Society of Civil Engineers' standards, must develop tensile strength per square inch as follows:

After being kept in air 24 hours, 250 lbs.

After being kept in air 24 hours, and in water 6 days, 450 lbs.

After being kept in air 24 hours, and in water 27 days, 550 lbs.

Briquettes made of one part cement and two parts standard crushed quartz must develop tensile strength per square inch as follows:

After being kept in air 24 hours, and in water 6 days, 200 lbs.

After being kept in air 24 hours, and in water 27 days, 325 lbs.

Cement that checks or cracks when made into pats ½" thick with thin edges on a sheet of glass, or which develops undue heat when mixed with water will not be accepted.

The cement must not have its initial set within 30 minutes, nor its final set within one hour.

To obtain first-class cement, other tests may be used if considered necessary by the chief engineer.

The right is reserved to reject any brand which the chief engineer considers is not adapted to the work.

8. Sand.—Two classes of sand will be used. The first shall be imported, silicious, clean, sharp-grained, coarse, free from dirt and all organic matter and shall be screened and washed if so ordered by the chief engineer. The second class shall be clean, sharp-grained, coarse, free from dirt and organic matter, equal to the Cojimar River sand, and shall be screened and washed if so ordered by the chief engineer. All sand used in mortar for pipe or brick joints and in all concrete for the body of sewers and drains, or in mortar or concrete used for the prevention of infiltration, shall be of the first class. For concrete masonry or mortar in masonry, other than specified above, the second class may be used.

9. Broken stone.—Broken stone used in concrete masonry must be small enough in largest dimensions to pass through a ring two inches in diameter, shall be thoroughly cleansed from all foreign substances, and shall be screened and washed if so ordered by the chief engineer. It shall be strong, hard, and durable, and equal in quality to the best that can be obtained in the vicinity of Havana.

10. Masonry stone.—Stone for foundations and backing shall be of sound and durable quality, equal to the best building stone found in the vicinity of Havana, free from cracks and seams, and having top and bottom beds approximately parallel. No stone shall be less than 4 inches thick, 12 inches long, and 8 inches wide.

11. Iron castings.—All iron for castings shall be of a superior quality of gray iron remelted in a cupola or air furnace, shall be tough and of even grain, and shall be free from uncombined carbon when examined under the microscope.

All castings shall be clean and perfect, free from blowholes and sand holes or other defects. They shall conform in all respects to the dimensions and weights as shown on the drawings.

Specimen bars of the metal used shall be furnished to the chief engineer as required.

Test bars for the tension test shall be 1 sq. inch in section and 14 inches in length.

Test bars for the flexure test shall be 3 inches wide, ½ inch thick, and 20 inches long.

The metal shall possess a tensile strength of not less than 18,000 lbs. per square inch.

The bar for the flexure test when broken transversely on supports 18 inches apart, and loaded in the center, shall have a breaking load of not less than 1,000 lbs. and shall have a total deflection of not less than ⅝ of an inch.

The contractor shall notify the chief engineer whenever any castings are to be made, and the latter shall have the right to have a representative present at any stage of the work. The test bars shall be poured at any time directed by the chief engineer, before or after the castings have been or while they are being poured.

The castings shall be thoroughly cleaned of all lumps, and subjected to careful hammer tests, after which they are to be heated in a suitable oven to a temperature of about 320° F., and while at this temperature be immersed in a bath of hot coal-tar pitch varnish, prepared, in general, according to Dr. R. Angus Smith's process.

12. Cast-iron pipe.—Cast-iron pipe shall conform to the above specifications, and in all respects to the weights and dimensions shown on the plans. No pipe of full length will be accepted whose weight is less than the specified minimum weight, nor shall the average weight exceed the specified weight by more than two per cent. The branches and all other specials must not vary more than five per cent from the weight as given on the drawings, and must conform in all dimensions.

13. Wrought iron.—All wrought iron must be tough, ductile, and fibrous, of a uni-

Digitized by Google

form quality, free from crystalline structure, cinders, flaws, or cracks. In bars it must have an ultimate tensile strength of 50,000 lbs. per square inch. Iron which has been burnt in the forge will be rejected. Each wrought-iron piece shall correspond in all respects to the dimensions specified.

14. Timber and piles.—All timber and planking for foundation shall be of the best quality of sawed, long-leafed yellow pine, or its equal in native timber, to be straight, sound, free from sap, wind shakes, large knots, worm holes, or other imperfections that may impair the strength or durability. Piles shall be of black jucaro or jiqui, sound, free from knots, wind shakes, or warps. They shall be not less than 12″ in diameter at the larger end, unless otherwise shown on the plans, and not less than 7″ at the smaller. Sheet piling, unless otherwise directed in writing by the chief engineer, shall be of good, sound, yellow-pine planking, three inches thick, tongued and grooved, and driven with a ram to the required depth, so as not to crack or split.

15. Foundations.—Piles to carry platforms will be driven where ordered by the chief engineer. The heads shall be tapered and protected with a hood and the points sharpened and, if necessary, shod. The piles shall be driven to the required depth and cut off truly and evenly at the elevation required. Where piles can not be driven more than eight feet, a platform only may be required, or rubble masonry foundations without platforms, extending to suitable bottom, shall be substituted as directed.

The spaces around the piles and caps up to the under side of the planking of the platform shall be filled in with good earth, thoroughly rammed or puddled unless otherwise shown on the plans or directed by the chief engineer. The word platform includes both the capping and planking.

The platforms shall be built according to the plans. When placed upon piles they must be nailed to each with wrought-iron drift bolts of the best quality iron, of the sizes and character as shown on the plans. Holes must be bored for spikes, bolts, or nails, to prevent splitting.

The planking, in general, shall not be less than eighteen feet long, laid according to plans, closely joined and spiked to the capping with nails or spikes, with broken joints of at least six feet.

If cradles or platforms are laid directly on the ground this must be graded perfectly even and smooth to receive them, and give a good and firm bearing throughout. If caps or sills are used, the spaces between them and under the planking must be filled with good earth, thoroughly rammed.

Foundations will be paid for as extra work, at the prices bid for the different materials of which they are composed, i. e., piles, lumber, concrete, and rubble masonry. No concrete or masonry will be considered as foundation which is above the lowest element and inside of the extreme lateral element of the sewer or drain proper. The concrete placed to form a bed for the sewer or drain, where the character of the ground is such that the external form of the construction can not be preserved, as described in paragraph 2, and that placed between sewers and drains in the same trench as described in paragraph 23, will not be considered foundations and shall not be paid for as extra work.

16. Mortar.—There will be three classes of mortar.

The first class is to be composed of one part of Portland cement and two parts (by measure) of sand of the first class, as described above, to be incorporated in a dry state, and mixed with clean water to the proper consistency, to be determined by the chief engineer, and shall be used while fresh.

The second class will be similar, except that sand of the second class, as specified above, shall be used, and that the proportion shall be one to three.

The third class shall be similar to the first, except that the proportions of cement and sand shall be one to one.

No mortar that has been set may be used.

Mortar of the first class shall be used for the concrete of the first class, as specified below, in all brick masonry and for plastering.

Mortar of the second class shall be used in rubblestone masonry and in concrete of the second class.

Mortar of the third class shall be used for joints of sewer and drain pipe.

17. Rubble masonry.—Rubble masonry foundation is to be built where ordered by the chief engineer, and is to be constructed of stones of good quality, hard, clean, and of good bed and build. They are to be laid in full beds of Portland cement mortar of the second class, and all joints are to be filled with the same. The stones shall be laid so as to break joints, with a sufficient number of header courses to insure thorough bonding. The interstices are to be entirely filled with spawls and mortar. Each stone is be cleaned and moistened immediately before it is laid.

Digitized by Google

18. Brick masonry.—The bricks must be clean and thoroughly wet by immersion before using, and those with the smoothest faces are to be laid in the inside courses, the smoothest edge to face out. Every course shall be laid with a line.

Every brick must be laid in full Portland cement mortar joints which for each brick must be formed in one operation, and no working in of the mortar will be allowed.

No joints shall exceed three-eighths of an inch in thickness. All joints on the face are to be trowel struck.

All unfinished brick work is to be racked back in courses, and when new work is to be joined to it the surface of the bricks must be cleaned and moistened.

Brick masonry of sides and arches shall be bonded and keyed as directed, especial care being exercised with each ring against laying too large joints at the back. All joints shall be normal to the section of the sewer, and all "lipping" of brick must be carefully avoided.

Where pipe connections enter a sewer or manhole, "bulls-eyes" shall be constructed by laying row-lock courses of brick around them, two such courses being laid around pipe more than 15 inches in diameter.

All inverts or bottom curves shall be worked from templetes, accurately made, according to the dimensions of the sewer, and correctly set to lines and grade furnished. The inverts of sewers are to be plastered $\frac{3}{8}''$ thick on curves with mortar of the first class. Before applying the plaster, the joints of the brick work shall be raked out and cleaned to the depth of at least $\frac{1}{2}''$ and sufficient to provide for a bond between the brick work and plaster.

The centers upon which the arches are formed must be made strong, and according to the shapes and sizes required. No center shall be removed until the work upon it has been well set, and the refilling has progressed up to the crown of the arch, if so ordered. All centers must be struck and drawn with care, so as not to crack and injure the work.

19. Vitrified brick masonry.—Each course of vitrified invert bricks shall be laid in full mortar joints truly on line, and the joints on the face shall not exceed $\frac{3}{16}$-inch in thickness. The inverts of all brick and concrete sewers and drains shall be of vitrified brick. The portion of brick sewers and drains above springing line may be common brick except where otherwise shown on the plans.

No masonry is to be built on a concrete foundation before it is thoroughly set.

20. Concrete.—Concrete shall be of two classes.

The first class shall be composed of one part of Portland cement, two parts of sand of the first class as described above, and three parts of broken stone.

The second class shall be composed of one part of Portland cement, three parts of sand of the second class, and five parts of broken stone.

Concrete of the first class shall be used in the body of all concrete sewers and drains and the base of pipe sewers and in manholes and flush tanks, and in such other places as are hereafter stated in the specifications or shown on the plans.

Concrete of the second class shall be used in foundations. The class of concrete to be used at other places than those mentioned shall be determined by the chief engineer.

The proportion given above shall be by measure, and the materials shall be accurately measured for each batch, the cement being measured loose. The mixing may be hand or machinery, but in either case it must be thorough, and to the satisfaction of the chief engineer.

Concrete shall not be mixed in larger quantities than required for immediate use. It shall not be used after it has begun to show evidence of setting, and no concrete which has once set shall be used as metal for mixing a new batch. Concrete shall not be thrown or dumped from a height, and must be carefully placed so that the uniformity in the distribution of the constituents may not be disturbed.

Concrete shall be spread in horizontal layers, not exceeding six inches in thickness, and shall at once be thoroughly compacted by ramming. One course shall follow another as rapidly as possible. Where fresh concrete is to be placed in contact with that already set or partly set, all loose stone or concrete not thoroughly compacted shall be removed from the surface of the latter, which shall then be washed clean of dirt and slushed with neat cement. When concrete is in place, all wheeling, working, or walking on it must be prevented until it is firmly set, and until such time it shall be kept damp and protected from the sun.

Such forms and centers as may be necessary to give the finished concrete the desired form shall be used. Special care must be taken to make the forms true and smooth; the center must be cut accurately to the form of the sewer, and the lagging must be of such width and so joined as to give a true and smooth cylindrical surface

Digitized by Google

to the interior of the sewer or drain. If so directed, the lagging shall be tongued and grooved, and, if necessary, drawings of the forms required will be made by the chief engineer, and the contractor will be required to adhere strictly thereto. They shall be sufficiently stiff and substantial to retain the concrete firmly in place, and shall not be withdrawn until the same has set to the satisfaction of the chief engineer. Concrete arches must be allowed to set at least 24 hours, and as much longer as the chief engineer may order, before any back filling or other weight is placed upon them.

21. Plastering.—As soon as practicable after the keying up is completed, the back of every arch of brick or concrete shall be thoroughly cleaned of dirt and the loose or projecting mortar, and shall be smoothly plastered from the spring line to the crown with a coat of mortar of the first class, $\frac{1}{2}$-in. thick for all sewers and drains. This coat shall be allowed to become fully set before any back filling is placed or walking allowed upon it.

22. Laying sewer pipe.—The trench shall first be excavated by the use of the prescribed form to the required depth, shape, and dimensions; concrete of the first class shall then be compactly rammed in the bottom to the required depth, and its upper surface brought to a plane lower than the grade of the sewer by the thickness of the wall of the pipe. A small hole will be left or excavated to receive the bell, and the pipe must be perfectly supported throughout its entire length upon its concrete bed.

Before laying, the interior of the bell shall be carefully wiped smooth and clean, and the annular space shall be free from dirt, stones, or water. The joints shall be filled with mortar of the third class. Special care must be taken to properly fill with mortar the annular space at the bottom and sides as well as at the top of the joints. After such space has been filled, the cement having been compacted with a wooden or iron calking tool, a neat finish shall be given to the joint by the further application of a similar mortar to the face of the hub so as to form a continuous and even beveled surface from the exterior of said hub to the exterior of the spigot all around. Concrete of the first class shall then be rammed on the sides and haunches of the pipe to the full specified width and thickness, care being taken that no void spaces exist. The greatest care must be exercised that the alignment and grade of the pipes be not disturbed. During suspension of work at night a suitable stopper shall be placed in the last pipe laid to prevent earth from washing in. Upon completion, the sewer must be left straight, clean, smooth, and in every other respect acceptable. Mortar and concrete shall be allowed to set before any back filling is placed, or walking allowed on the sewer, and the greatest care taken not to disturb the pipe or haunching.

Pipes having any defects which do not cause their rejection must be laid so as to bring these in the top half of the sewer.

The interior of all pipe shall be carefully freed from all dirt, cement, or superfluous material of every description as the work proceeds, for which purpose a disc mould or swab filling the entire bore of the pipe and attached to a rod sufficiently long to pass two joints from the end of the pipe last laid, shall be continuously worked through.

23. Laying drainpipe.—The specifications for laying sewer pipe are understood to apply to the case of laying drainpipe, except that sand for bedding shall be used instead of concrete.

Where the space between drains and sewers in the same trench is less than one foot such space must be filled with concrete of the second class for a width equal to the external diameter of the sewer construction without extra compensation.

24. Closing dead ends.—The ends of all pipes, junctions, and branches when not immediately used must be closed with masonry or vitrified-clay caps.

25. Back filling.—The back filling must be brought up evenly on both sides of the sewer with the best material from the excavation, so that no unbalanced pressure shall be brought upon the masonry. Loose, fine earth, free from stones, shall be used up to a point two feet above the sewer. The remainder of the trench shall contain not more than one-third broken rock, and no stone of this shall weigh more than 50 pounds. If necessary to meet this requirement the contractor shall supply suitable material for back filling. It shall be spread in horizontal layers not exceeding six (6) inches in depth before ramming, and thoroughly rammed to the top of the trench. Not less than two men shall be employed in ramming for each shoveller engaged in replacing the back filling, which shall be compacted with iron-shod rammers, each weighing not less than twelve pounds. When the back filling is deposited by means of wheelbarrows, carts, or wagons, or by machinery, the ramming shall be done as directed by the chief engineer. Water tamping, if allowed, shall be done as directed by the chief engineer.

All slides or caving of sides of the trenches or cuts shall be taken out and back filled by the contractor.

Digitized by Google

As the trench is refilled, the bracing, etc., shall be removed in such manner as to prevent the caving of the sides of the trench. If sheathing is used, so much of it as extends below the crown of the arch must be withdrawn, unless otherwise directed by the chief engineer, after refilling over the haunches, but before more than six (6) inches of earth is placed on the crown of arch and before the center is struck. As the sheathing is withdrawn the vacancies left by each plank shall be carefully filled by ramming, with tools especially adapted for the purpose, by watering or otherwise, as may be directed.

26. Timber and planking.—The contractor is required to have a sufficient quantity of timber and planking constantly on hand for bracing, sheet piling, fencing, or shoring, in order to be used immediately in case of accident.

27. Disinfection.—The contractor shall at all times keep the work in a sanitary condition, and shall take such measures to secure this condition by disinfection or otherwise as the chief engineer may order. All materials taken up and all earth uncovered shall be thoroughly soaked with disinfectants to the satisfaction of the chief engineer. The disinfectant used shall be a solution of chloride of lime in the proportion of one pound of chloride of lime to 10 gallons of water, or electrozone furnished by the city at its work, of a strength not less than 125 grains available chlorine per gallon. All hauling and application of electrozone to be done by the contractor. No guarantee is made as to the amount of electrozone that shall be furnished by the city. Quicklime will also be use when so directed.

28. Manholes.—Manholes shall be built according to plans and at such places as the chief enginer may direct. The brick work shall be in all respects of the quality described above, except that a small proportion of bats or half bricks may be used not to exceed 1-5th of the whole number in any case, and the manholes must be built from templets to guide the work. The connection with the arch must be true and secure, and in the manner shown in the plans. The joints are to be neatly struck and pointed on the inside, and the inverts and the outside of the brickwork must be neatly plastered 3-8th inch thick with mortar of the first class. Wherever possible split pipe shall be used for the invert. Galvanized wrought-iron rods or steps of good quality are to be built into the brickwork as shown on the plans. The steel rails shown in the combination manholes must be of first-class quality, weighing not less than 50 lbs. to the yard.

29. Receiving inlets.—Receiving inlets shall be built according to plans and specifications, and in such places as may be ordered by the chief engineer.

Manholes and receiving inlets shall be fitted with cast-iron covers which shall conform to the specifications for cast-iron given above and to the detailed plans.

30. Outfalls.—Outfalls shall be built according to the detailed plans for each case. They shall in general be carried out to a depth of ten feet of water. On the sea front they shall be of flanged cast-iron pipe, protected from wave action by concrete of the first class, as shown on the plans. On the harbor front they shall be supported on a pile and concrete foundation, as shown on the plans. The contractor shall remove at his own expense all obstructions which may be on the location of the proposed outfall, and shall restore to their original condition any structures on the water front which it may be necessary to disturb in the progress of the work.

31. House connections.—Slants, Y or T branches, shall be inserted in the sewers for house connections, as shown on the plans, and the cost thereof shall be included in the price per linear-meter bid for the construction of the sewer. House connections of 6″ vitrified pipe shall be built according to the plans and specifications for pipe drains to the sidewalk line and connection made with existing house connections where such exist. They shall be located as designated by the chief engineer. In all cases where connection is not made with existing house connections the end of the pipe must be closed with a vitrified stoneware cover set in mortar. When the depth of the street sewer is greater than ten feet, a drop connection will be made thereto, as shown on the plans.

Where shown on plans or directed by the chief engineer the contractor shall continue the house connections to the sewers from the sidewalk line to the point where the ventilator connection is made. This portion of the sewer connection and the ventilator shall be of 6″ cast-iron pipe, laid according to specifications herein for laying cast-iron pipe, and as shown on the plans.

Slants, Y or T branches, shall be inserted in the drains for inlet connections, as shown on the plans, and for house connections where ordered by the chief engineer, and the cost thereof shall be included in the price per linear-meter bid for the construction of the drain. The inlet connections shall be of 10″ pipe, laid according to the specifications for laying drainpipe.

Where directed by the chief engineer, house connections for drains of six-inch vitrified pipe shall be laid, according to plans and specifications, from the drain to the sidewalk line, and the necessary specials inserted in the drain.

Digitized by Google

32. Valves.—All valves used in force mains and siphons shall be iron-body, bronze-mounted, double-disc gate valves. The material used in all facings and valve stems shall be of the best quality composition metal, and must be approved by the chief engineer. All valves larger than 36″ diam. shall be geared and furnished with a by-pass.

The design of all valves shall be approved by the chief engineer.

Gates shall be of such forms and dimensions as are shown on the plans. All facings shall be of approved composition metal. The body of the gates shall be of cast iron.

33. Laying cast-iron pipe.—In laying cast-iron pipe of the hub and spigot pattern the excavation shall be made to conform as nearly as possible to the shape of the pipe, and the pipe shall have full bearing throughout its length. The spigots of the pipes shall be so adjusted in the hubs as to give uniform space all around. The joint shall at all points be at least 5-16″ in thickness. The depth of the lead shall not be less than 3 1-4″ for pipe larger than 15″ in diameter, nor less than 2 1-2″ for smaller pipe. Gaskets of clean, sound hemp or jute, tightly driven, shall be used to pack all joints. The lead shall be pure and soft, and adapted for the purpose of running joints. Before running the lead the joint shall be clean and dry, and the joint shall be poured full at one pouring. The caulking shall be carefully done and a tight joint made. The lead is to be left flush with the face of the socket.

The same precautions for cleaning pipes must be used for cast iron as for sewer pipe. All the requirements for trenching, alignment, grades, back filling, etc., specified for pipe, brick, and concrete sewers shall apply to cast-iron pipe laying.

34. Force mains.—Force mains shall be laid according to the specifications for laying cast-iron pipe.

35. Siphons.—The three siphons at Infanta and Concha streets, and across the Matadero Creek near Cristina Bridge, shall be of cast-iron pipe, with manholes and valves at each end, of the forms and dimensions shown on plans. The one at Infanta street shall consist of two 30″ pipes approximately 100 ft. long; that at Concha street, two 16″ pipes, approximately 50 ft. long; that at Cristina Bridge, two 24″ pipes approximately 100 ft. long.

Suitable bulkheads, to be approved by the chief engineer, shall be built, and the pipe laid according to the specifications for laying cast-iron pipe.

36. South side pumping station.—The building for this station shall be of the type specified herein for the Morro station, and shall be of suitable plan and dimensions to receive the necessary machinery for pumping 14,250,000 gallons of sewage per day, with a maximum rate of 21,375,000 galllons per day, the lift being 21 feet. For this work there will be required three 8,000,000-gallon centrifugal pumps, operated by direct-connected compound condensing engines, and three 60-horsepower return tubular boilers, of approved make, together with all necessary appurtenances, including feed-water heater, mechanical stoker, and induced draft. Two pumps and two boilers only will be installed at present, but foundations will be prepared for all. The entire plant, so far as possible, shall conform in general to the specifications for the building and equipment of El Morro pumping station.

37. Vedado pumping station.—The building for this station shall be of the type specified herein for the Morro pumping station, and shall be of suitable plan and dimensions to receive the necessary machinery for pumping 5,350,000 gals. of sewage per day, with a maximum rate of 8,025,000 gals. per day, the lift being 15 1-2 ft. For this work there will be required two 4,000,000-gallon centrifugal pumps, operated by direct-connected compound condensing engines, to be supplied by two 40-horsepower vertical boilers of approved make, with feed-water heater, and all necessary appurtenances, which shall also supply steam to two direct-connected electric generating outfits of 12 K. W. capacity for operating the two automatic electric lifts hereafter specified.

The entire plant, so far as possible, shall conform in general to the specifications for the building and equipment of El Morro pumping station.

38. Sublifts.—Two substations will be required, one at 5th and B streets and one at 7th and 16th streets, and will be underground masonry construction. At the former two sublifts will be required, each consisting of a motor and direct-connected centrifugal pump with a capacity of 2,500,000 gals. of sewage per day, the lift being about 9 ft. At the latter two sublifts shall be installed, each consisting of a motor and direct-connected centrifugal pump with a capacity of 800,000 gals. of sewage per day, the lift being 10.3 ft. Both substations shall be arranged to work automatically. The plant, so far as possible, shall conform in general to the specifications for the building and equipment of El Morro pumping station.

39. Sand catchers.—Sand catchers, or settling basins, will consist of two chambers for collecting sediment, with the necessary gates and appurtenances and hoisting apparatus for cleaning.

Digitized by Google

They will form a part of the pumping stations or wells to which they are adjacent, and will usually be covered by the buildings of the latter.

40. Works at La Punta.—At La Punta there will be built the following: Sand catcher, discharge well with gates and valves, centrifugal pump 30,000,000 gals. per day capacity, 11 ft. lift direct connected to electric motor, and a suitable building to cover them. These, together with an outfall sewer from the discharge well to the shore, will be permanent constructions. The contractor will be required to make, maintain, and operate, at his own expense, the necessary temporary arrangements, to provide for the disposal of the sewage until the completion of the permanent works for disposal. They will include all necessary pumping machinery and appurtenances, and an outfall sewer, preferably of wooden staves, which shall be carried to a point west and north of the discharge well to a depth of water not less than 25 ft. The approximate length of this outfall will be 1,000 ft. The entire plant so far as possible shall conform in general to the specifications for the building and equipment of El Morro pumping station.

41. Siphon across the harbor.—The siphon across the harbor shall consist of two 5 ft. flanged cast-iron pipes, with flexible joints, extending from the discharge well at La Punta to the Morro pumping station. The length is approximately 390 meters.

The pipe and joints shall conform to the requirements in paragraphs 11 and 12 for iron casting and cast-iron pipe. Each pipe will have a nominal laying length of 12 ft., and shall be cast in dry sand molds in a vertical position, and shall be provided with flanged ends. The pipe shall be truly cylindrical and the shell shall not vary from the thickness shown on drawings by more than one-tenth of an inch. After being coated as described in paragraph 11, the pipe shall be tested in a hydraulic press to not less than 200 lbs. per square inch. If this test proves satisfactory, the pipe shall be ready for machining. The machining shall consist of facing the flanges in a lathe and drilling the bolt holes. The castings forming the flexible joint shall be of the general dimensions shown on the plans and shall be machined in a manner to bring them to the exact form shown. The spherical surface of the spigot shall be truly turned to a spherical form and left with a smooth lathe-cut surface. The flange shall be faced and drilled. The bell piece shall be machined on the two points of contact with the spherical spigot. Both flanges of the bell shall also be faced and drilled. The ring attached to the face of the bell piece shall in like manner be faced and drilled to correspond with the bell.

After the pieces are machined in the foregoing manner, the joints will be made up in the manner and with the material shown on the plans. There will first be a ring of lead of not less than 1″ thickness in the bottom of the bell. When this is done, the ring will be bolted in position on the face of the bell and the joint filled to within 2″ of the end with Portland cement mortar. After this mortar is properly set, the remaining depth of joint will be filled with lead. Each completed flexible joint piece will then be tested in the following manner:

It shall first be given its complete limit of deflection of ten degrees, then brought back to its normal position. To each of the flanges will then be bolted a blank flange. These blank flanges will be further secured in their relative positions by bolts extending from one flange to the other. When in this position, the joint shall be tested with a pressure of not less than 50 pounds per square inch. Under this test the castings themselves must show entire freedom from leakage. It is to be expected that the joint where the slipping motion resulting from deflection occurred will show a certain amount of seepage; this, however, must not be excessive, and if deemed so by the chief engineer the joint must be remade.

The thickness of castings and form of same, the size and number of bolts, are to be as shown on the plans.

The drilling of the flanges shall be done accurately to gauges and in such a manner as to insure the free bolting of the various parts together both in the shops and at the point of laying.

A trench shall be excavated in the bed of the harbor upon the lines indicated upon the plans, and the bottom brought to proper grade with concrete of the second class, the method of placing to be approved by the chief engineer. Where sand or soft material is encountered, a special foundation of grillage embedded in concrete shall be built as shown on the plans, if so ordered by the chief engineer. One pipe only will be laid at present, but the cut and foundation must be made of sufficient dimensions to receive both, being 20 ft. in width, and the first pipe must be so placed as to leave room for the second. The number of flexible joints required will be determined by the chief engineer. After being properly jointed and connected, pipe shall be laid in a manner to be approved by the chief engineer, and the appliances furnished by the contractor for doing the work must be ample, in his judgment, for its

Digitized by Google

satisfactory and expeditious performance. After laying, concrete will be placed under and on the sides of the pipe to give it a full bearing throughout its length.

Necessary precautions will be taken by the contractor to prevent interference with navigation, and he will conform to all regulations prescribed by the captain of the port and the department of works of the port.

The work shall be left in a clean condition, and connections made ready for operation.

The bidder may, if desired, submit in addition to his bid for the siphon above described an alternate proposition for the construction of the siphon across the harbor. Such proposition must be accompanied by general plans and specifications, and if required by the chief engineer, detailed plans shall be furnished. Measurements and payments shall be on the same basis as provided in these specifications for the construction of the flexible-joint siphon. This alternate proposition shall be attached to and form part of the proposal for the construction of the sewer system.

42. Morro pumping station.—The building and equipment shall conform to the following general specifications, which shall also apply to all other pumping stations:

Foundation.—Excavations shall be made to a necessary depth to secure sound foundation, If, in the judgment of the chief engineer, it is necessary to drive piles, the piles shall be of sound jucaro or other approved native hard-wood timber. They shall be straight, peeled, and properly pointed, and, if required, shod with cast or wrought iron shoes, and capped with iron rings to prevent splitting. Piles shall be driven to a penetration of not over one inch under a 2,000 lb. hammer falling 25 feet. If deemed advisable by the chief engineer, the foundation footings shall be composed of concrete and steel I beams, dimensioned by approved formulae according to bearing power of soil encountered. Foundations up to grade line shall be of concrete of the second class.

Floors shall be of concrete, of the second class, 5 inches thick, and finished with a top coat of Portland cement mortar three-fourths of an inch thick composed of one part cement and one part sand of second class, which will be spread a true surface over concrete base, before setting, and thoroughly troweled and smoothed. Floors shall be laid in blocks of not over 3 feet square.

On the outside of foundations, to the height shown, and elsewhere as shown on the plans, shall be placed a water proofing sheet composed of ten thicknesses of tar paper and asphaltum of approved quality, thoroughly swabbed together.

At grade line there shall be placed a beveled water table 6″ x 8″.

Walls.—The walls shall be of hard-burned American brick, or its equal, broken up into pilasters, arches, etc., as may be necessary to present a pleasing architectural appearance. Bricks shall be laid in cement mortar of the first class, with enough well-slacked lime to give plasticity. Every fifth course shall be headers. Work shall be well bonded and joints broken.

Roof trusses shall be of steel, dimensioned according to span and load, and all structural steel and iron work shall meet the requirements of the specifications adopted by the Association of American Steel Manufacturers and of Carnegie's standards.

Roof.—Upon the purlins supported by the trusses there shall be placed 7-8″ T. & G. sheathing, upon which strip shall be placed to receive first-class red Marseilles tile. Roof timbers to be of first-class yellow pine. All valleys to be copper flushed. All ridges and hips to be topped with angle tile laid in cement mortar.

Doors.—All doors shall be of two thicknesses of yellow pine. Transoms shall be placed over all doors. All window sash shall be of first-class white pine, and all glass shall be best American double-thick glass. All doors, windows, and inside finish must be of best design and workmanship. All hardware shall be first-class.

Inside partitions shall be "hollow," and composed of 2″ steel channel studs to receive expanded metal lath, upon which will be placed two coats of mortar composed of lime, Portland cement, hair, and sand properly proportioned and applied.

Plumbing.—Plumbing fixtures shall be sufficient to supply the needs of the employees, and the work shall be done according to the best United States practices, and shall be properly trapped, vented, and back aired. Closets shall be syphon jet, with porcelain bowls, hard-wood seats, and hard copper-lined cisterns, and shall be set in putty on brass floor flanges connected with lead bend, which shall be caulked with brass ferrule, with hub of standard soil pipe. Out of the lead bend a lead connection shall be taken to a 2-inch galvanized iron revent, which shall be carried to cast-iron stack, and extended above the roof. All water pipe, etc., shall be galvanized iron. Slop sinks and basins shall be of first-class enameled iron. Urinals shall be porcelain lip. In the building all soil and sewer pipe shall be cast iron. Sewer connections will be made with vitrified pipe.

Digitized by Google

Lighting.—Buildings shall be piped for gas and wired for electric light. Fixtures shall be first-class combination oxidized bronze. Wiring shall be first-class throughout, and done according to the rules submitted by the Board of Fire Underwriters, New York City. Armored iron conduit shall be used throughout. Switch boards properly arranged and constructed shall be placed where required.

Painting.—Exterior work, and interior and exterior surfaces of brick work, also of partitions and iron work, shall receive three coats of pure white lead and linseed oil, colored as directed. All interior wood work shall be rubbed down thoroughly and receive a hard oil finish. All details shall be approved by the chief engineer.

The building construction as a whole must meet the requirements of the building laws of New York City, and shall be prosecuted according to the ordinances of the city of Havana.

Machinery and equipment.—The Morro station shall be of proper dimensions to receive all the pumping machinery and appurtenances for pumping 92,000,000 gallons of sewage per day, with a maximum rate of 138,000,000 gallons, the total lift being 24 ft. For this work three 46,000,000-gallon centrifugal pumps, operated by direct-connected triple-expansion engines, to be supplied by five 150-horsepower water-tube boilers, of approved make, with induced draft, feed-water heater, mechanical stoker, and all necessary appurtenances, will be required. Two pumps and three boilers only will be at present installed, but proper foundations will be built for all. All necessary filth hoists, screens, gates, valves, etc., including two 140-meter cast-iron pipe force mains 4 ft. in diameter, with the gates, will be considered a part of this station.

A set of drawings will be furnished by the chief engineer, showing the approximate location of pumping station, and suggestions of an acceptable arrangement of the pumping station, pumps, boilers, coal house, and other appurtenances. This design may be modified more or less by the contractor, and all such modifications must be approved by the chief engineer.

Four months after the award of the contract the contractor must submit complete general and detailed plans and specifications of the proposed work and machinery for the approval of the chief engineer.

The general plans must show the position of the engines, pumps, boilers, traveling crane, condensers, feed-water heaters, auxiliary engines, dynamos, steam-piping, boilers, fans, stack, conveyors, mechanical stokers, foundations, floors, platforms, gates, pump wells, and all other appurtenances complete, giving all dimensions.

The detailed working drawings shall show all details. The kind of material to be used in every part must be clearly denoted in the drawings by different section lining or by distinct lettering.

The proposed steam pressure shall not be less than 165 pounds per square inch.

If during the construction it should be expedient to change or modify the design, the contractor must submit to the chief engineer complete working drawings showing the proposed changes which must be approved by the chief engineer.

Before the pumping station is accepted for operation by the city the contractor must deliver to the chief engineer a complete set of general and detail tracings of the engines, boilers, and all appurtenances as actually built and erected at the pumping station.

The general tracings shall show the engines, boilers, and auxiliary apparatus in position in at least four different views, sectional side elevation, sectional end elevation, contour or outline end elevation and plan, and shall give necessary main dimensions, thickness, and kind of metals, location of foundation bolts, and all important sizes of machinery as erected.

The detail drawings shall show all details as constructed, in sectional, outline, and plan views, with all dimensions plainly written in neat and intelligible figures, and names printed at every detail, the kind of material used, and the finish.

These drawings shall be made on first-class tracing cloth, and the sheets shall be uniform in size.

The engines, boilers, and appurtenances must be of a type and make approved by the chief engineer, and shall conform to the following specifications:

Engines.—Each pump and engine must be capable of easily lifting 46,000,000 (forty-six million) gallons of sewage per day, 24 feet above the level of the sewage in the suction chamber.

Each pump and engine must also be capable of pumping at as low a rate as 15,000,000 (fifteen million) gallons per day, and at all rates between 15,000,000 (fifteen million) gallons and 46,000,000 (forty-six million) gallons per day. The capacities must be demonstrated by suitable trials to be carried out as outlined below.

The efficiency of the pumps shall be not less than 70 per cent.

The efficiency of the combined pumps and engines shall be not less than 60 per cent of the I. H. P., and the steam engines must be guaranteed to require not more

Digitized by Google

than 13 pounds of dry steam per I. H. P. per hour, or on a 24-hour duty test the combined engines and pumps must develop a duty of not less than 90,000,000 foot-pounds per 1,000 pounds of dry steam supplied to the engine.

The engines and pumps and all other parts of the plant shall be designed and proportioned to provide for maximum economy; shall have ample working strength, stability, and stiffness, and shall be specially designed for the work to be done; and their material and workmanship, so far as affecting safety and proper service, shall be of the best quality.

There shall be ample room around all parts for erection, repairs, lubrication, inspection, and adjustment, and all parts of the pumping machinery and plant must be designed and made for long wear and few repairs. The various parts of the machinery shall be of plain shapes and forms, adapted to their specific purposes, insuring ample strength and reliability with good mechanical effects; shall be suitably finished, and so constructed and arranged as to work without undue noise or injurious shocks or vibrations.

All visible unfinished iron work, after the completion of the engines and other appurtenances, shall be cleaned, rubbed down, and painted with four coats of good quality paint and strictly pure linseed oil, the first coat to be applied at the shop and the others after erection.

The inside surfaces of pumps, pipes, etc., shall receive two coats of No. 1 paraffin varnish, applied hot at the shop and one after erection.

The paint shall be of a grade and color approved by the chief engineer. All parts to be covered by magnesia shall be thoroughly cleaned, freed from rust, and painted with two coats of paint before the covering is applied.

The following provisions (subject to change approved by the chief engineer) are to be followed so far as they are applicable to the plant of the accepted design: Bed plates or main frames shall be massive and well secured to the foundations with bolts of ample size. The steam cylinders of the engines to be of cast iron. If they are steam jacketed, suitable provision for expansion shall be made. The cylinders shall be counterbored so that the pistons will run over at least one-half inch. Pistons and cylinder heads shall be faced off and definite end clearance given them when the piston is at either end of the stroke. The pistons are to be cast hollow and all core vents plugged steam tight. Valves and valve seats to be scraped or ground so as to be steam tight, and cylinder heads to be scraped or ground tight on narrow joints. The upper ends of nuts or foundation bolts are to be polished.

All steam and water piping and valves of sizes 3 inches in diameter or less, used in connection with the engines and pumps, or other auxiliaries directly connected with the engines, shall be of brass. All brass pipe and fitting above the engine-room floor not covered by a nonconductor covering shall be polished.

All connecting rods, piston rods, shafts, crank and cross-head pins shall be of Bethlehem open-hearth steel. Piston rods are to be perfectly keyed to the cross heads, and the edges of the keyways in both rods and cross heads are to be semicylindrical. Connecting rods and main links must be provided with boxes lined with Babbitt metal, hammered in after being poured. The composition of the Babbitt metal shall be 85 per cent tin, 10 per cent antimony, and 5 per cent copper.

Piston rods shall be packed with metallic packing, and valve stems with soft packing. All small connections operating the valve gear, where not provided with adjustable boxes, must have eye ends bushed with hardened steel bushings forced in and lapped out truly cylindrical. The bushings must be $\frac{1}{64}$ inch shorter than the eyes. The cranks are to be forced on the shafts and the crank pins forced in, and a record of the total pressure required to bring them home shall be kept by the contractor. The cranks are to be keyed to the shafts. No shrinking fits will be allowed.

All forcing here referred to shall be done with a hydrostatic press, and the difference in the diameters of the parts to be forced together shall be one-thousandth of the smaller.

Each cylinder shall be provided with an exact and substantial indicator gear of the pantograph type. A rod shall run from this gear toward the indicator, of such length that the cord shall be about one foot long. The connections with the cross-heads shall be capable of being attached or detached while the engine is running, and means for hanging up the cross-head end when not in use shall be provided.

Each engine must be provided with an accurate speed indicator and a sensitive high-speed centrifugal governor, and it is desirable that the range of cut-off shall be from 0 to $\frac{3}{4}$ of the stroke on the high-pressure cylinders, the cut-offs on other cylinders being fixed or variable as the contractor may prefer. The governor shall be capable of quick and ready adjustment while the engine is running and shall be arranged to control the engine at varying speeds and to prevent its running beyond its safe maximum speed under any conditions.

Digitized by Google

All cylinders are to be provided with independent eccentrics for the inlet and exhaust valves.

All throttle valves are be arranged so that they can be operated from either the engine-room floor or the engine gallery. The cylinders and steam pipes are to be covered with approved carbonate of magnesia 1¼ inches thick, and the cylinders are to be lagged with smooth sheet steel, except the heads, which will be provided with polished false covers.

Parts of the engines that are likely to be displaced by vibrations must be joined by ream bolts, made a driving fit where practicable, and where not, keys and tapered dowels are to be used.

All nut seats shall be faced for a square bearing of nuts, and all nuts shall be of the United States standard. Those to be frequently removed must be case hardened. For all nuts in the plant there must be furnished well-made wrenches, those for finished nuts being finished, marked, and attached to a neat and substantial case, which shall be fixed to the wall of the engine room. The running parts of the engines and the valve gears are to be well finished and highly polished. The valve gears and starting arrangements shall be such that each engine can be safely and promptly started and operated by one man. All stuffing boxes shall be readily accessible for inspection and so far as practicable for tightening up while the engines are running. Each main bearing shall be of ample size and strength, and shall be capable of adjustment in two lateral directions if a vertical shaft is used. Oil holes shall be readily accessible, and separate sight-feed oil cups shall be used on pins and main links. Each cylinder shall have an acceptable mechanically operated lubricator.

A tubular feed-water heater of ample size and with brass or copper tubes is to be inserted in the low-pressure exhaust pipe of each engine.

A mercury column for indicating the dynamic head on the pumps in the duty trials will be furnished and connected up by the contractor.

All oiling apparatus must be of the most modern kind, with reference to effectiveness and economy of oil.

Oil-tight drip pans with drain pipes and valves shall be provided at all places where necessary for receiving and conveying oil or water. These pans shall be of brass and galvanized iron as the chief engineer may direct.

The machinery shall be so arranged that any important part of the substructure can be easily disconnected and hoisted out of the pump pit without removing or disturbing other parts of the machinery.

The impeller wheels shall be easily accessible for repairs, and be so placed that they can be easily removed from the main shafts.

Suitable manholes must be allowed in the casing of the pumps to allow cleaning out.

The contractor shall furnish and place check valves of ample strength and suitable dimensions at the discharge end of each pump. He shall also furnish and place suitable gauges for registering the height of the sewage in the pump well and discharge tunnel.

Travelling crane.—A travelling crane shall be furnished and installed in the engine room by the contractor. The crane shall be of sufficient capacity to easily raise and transport the heaviest single piece or part of the pump or engine, and its capacity shall be not less than fifteen tons. The crane shall be of the hand-travelling type, the operator to stand on a suspended platform which shall be attached to the trolley. The design must be acceptable to the chief engineer.

Condenser and air pump.—The condenser shall be of the surface type, of appropriate size and construction to maintain a steady vacuum, and shall be located at some point below the grade of the floor. The condenser shall be so arranged as to take circulating water from the force mains and return the same to the low-level sewer at the screen chamber. Ample and effective means of cleaning the condenser tubes must be provided. Connections shall be made with any water supply that the city may furnish.

Thermometers of approved make shall be furnished by the contractor and placed in position at the following points: One to show the temperature of the circulating water before entering the condenser and one to show the temperature of the water leaving the condenser.

The air pump shall preferably be directly connected with the engine and shall be of ample capacity for the work to be done, and shall be capable of maintaining a steady vacuum.

Boilers.—The boilers shall conform in general to the standard specifications for water-tube boilers given on page 803 of Thurston's Manual of Steam Boilers, edition of 1898, except that the heating surface allowed per horsepower shall be 12 square feet.

All other equipment of the pumping station shall be of the most modern and approved design and construction, and of the best material and workmanship.

Digitized by Google

43. Outfall tunnel and sewers.—The outfall tunnel and sewer from the end of the Morro force main to the outfall shall be a 7-ft. concrete sewer with vitrified brick invert, as shown on the plans. It shall be constructed in all respects as prescribed in these specifications for tunnel and open-cut sewers. In all cases where the top of the sewer is within two and one-half feet of the surface of the ground at any point embankment must be used to protect the sewer. The embankment must be at least two and one-half feet deep above the outside top of the sewers at any point, with side slope of one and one-half to one, unless otherwise ordered by the chief engineer.

44. Outfall well.—The outfall well shall consist of a brick masonry well from which the two iron offshore outfalls start. It shall be built according to plans to be hereafter furnished.

45. Offshore outfall sewer.—The offshore outfall sewer shall consist of two 5-ft. flanged cast-iron pipes with flexible joints laid in separate trenches to a depth of water of 30 ft. One pipe only shall be laid at present. The total length will be 550 ft. The pipe and method of laying shall be similar to that for the siphon across the harbor, as described in paragraph 41, except that the entire trench around the pipe shall be filled with concrete of the first class to one foot above the top of the pipe.

MEASUREMENTS AND PAYMENTS.

46. All linear measurements shall be taken along the axis of the work.

Measurements of sewers and drains shall be taken from the center of the uppermost manhole on each line to the center of the manhole at its junction with a main or lateral, or to the center line of such main or lateral at the junction, including all branches, manholes, or other appurtenances along the line.

The depth to rock given in the borings shown on the plans and profiles is guaranteed to the extent that all rock which is required to be excavated in doing the work called for by these plans and specifications, lying more than one foot above the line joining two adjacent borings in the same sewer or drainage line, measured along the axis of the sewer or drain, or for branches between the boring in the branch line nearest to the main into which the flow will pass and the depth to rock on said main at the point of junction as determined above, shall be classed and paid for as extra rock excavation.

In authorized tunnel work, the guarantee for borings will be held to provide that in case soft material is found below the line of rock shown by borings and determined as above, that portion of the length of the tunnel which lies wholly or in part in or within four feet of said soft material shall be paid for as extra work, as prescribed in par. 45 of the general conditions and not at the price named in the bid.

The bidder shall state a price per meter for each size of sewer and drain in each district, which price is to include all the necessary labor and materials for their construction as provided in these plans and specifications.

47. For the purpose of payment, manholes will be divided into six classes: (1) Single manholes for drains, (2) single manholes for sewers of less depth than 9 feet, (3) single manholes for sewers of greater depth than 9 feet, (4) combination manholes of less depth than 9 feet, (5) combination manholes of greater depth than 9 feet, (6) single manholes for main Matadero drain.

Combination manholes are sewer manholes having a chamber at the side giving access to a drain.

The depth of a manhole will be measured from the invert of a pipe sewer, and from the springing line of a brick or concrete sewer, to the top of the iron head when properly set.

The bidder will state a price for the construction of each of the above classes of manholes, which price is to include the furnishing of all materials and doing of all work involved in the construction of manholes, according to the plans and specifications.

48. Inlets will be divided into two classes and a separate price shall be bid for each class, which price will include all labor and materials involved in the construction of these inlets, according to plans and specifications.

49. Outfalls on the harbor front shall be paid for by the linear meter at the rate bid for the adjacent section of the drain.

Cast-iron outfall pipes on the sea front shall be measured by the ton of 2,000 lbs. The bidder shall state a price per ton of 2,000 lbs. for these outfalls, which price shall include all labor and material necessary to lay the pipe and protect it with concrete according to plans and specifications.

50. Measurements of house connections for sewers shall be taken from the outside (bell) end of the branch to the upper end of the connection pipe. The bidder will state a separate price per meter for vitrified pipe and for cast-iron pipe for these connections, which price will include all specials.

Digitized by Google

51. Measurements of ventilator pipes shall be taken from the outside (bell) end of the special in the house connection to the upper end of the pipe. The bidder will state a price per meter for ventilator pipes which shall include all specials.

52. Measurements of house connections for drains shall be taken from outside (bell) end of the branch to the end of the connection pipe. The bidder will state a price per meter for these connections which will include all specials.

53. Measurements of connections for street inlets to drains shall be taken from the outside (bell) end of the branch to the upper end of the vitrified pipe. The bidder shall state a price per meter for these connections which will include all specials.

54. The bidder will state a price for each valve in place, except where otherwise specified.

55. Measurements of cast-iron force mains shall be per linear meter in place. The bidder shall state a price per meter which shall include all the labor and materials necessary to lay the pipe according to plans and specifications.

56. The bidder shall state a lump sum for each of the three siphons at Concha and Infanta streets and at Cristina bridge, which price shall include all labor and materials for constructing the siphons complete, including manholes, valves, and all other appurtenances, according to plans and specifications.

57. The bidder shall state a lump sum for the construction of the south-side pumping station, which price shall include all the labor and materials required for the construction and equipment of said station complete according to the plans and specifications.

58. The bidder shall state a price for the construction of the Vedado main pumping station, which price shall include the doing of all work and the furnishing of all materials for the construction and equipment of said pumping station complete according to the plans and specifications.

59. The bidder shall state price for the construction of each of the Vedado sublifts, which price shall include the doing of all work and the furnishing of all material for the construction and equipment of said sublift, according to the plans and specifications, including insulated wire connection to the main Vedado pumping station, either in suitable underground conduits or on suitable supports in air, as directed by the chief engineer.

60. The bidder shall state a lump sum for the works at La Punta, both temporary and permanent, which price shall include the labor and materials necessary to construct, maintain, and operate same according to plans and specifications.

61. The bidder shall state a price per linear meter for the construction of the siphon across the harbor, which price shall include all labor, materials, and foundations required to complete the siphon according to plans and specifications.

62. The bidder shall state a price for El Morro pumping station which will include all labor and materials required for the construction and equipment of the station complete according to plans and specifications.

63. Measurements of the outfall tunnel and sewer will be per linear meter. The bidder shall state a separate price per meter for tunnel and for open-cut sewer, which prices are to include all labor and materials necessary for the construction of the sewer complete according to plans and specifications.

64. The bidder shall state a price for the outfall well complete according to plans and specifications.

65. Offshore outfall sewer shall be measured by the linear meter. The bidder shall state a price per meter which shall include all labor and materials necessary for its construction, including all foundations, according to plans and specifications.

66. The price for stone or concrete masonry, and for excavation, not otherwise provided for, shall be per cubic meter by actual measurement in place, provided such dimensions do not exceed those indicated or implied in the plans or instructions of the chief engineer. The bidder shall state a price per meter for each of these classes of work.

67. Measurements of extra haul beyond the kilometer required shall be per cubic meter in the carts and per kilometer along the shortest practicable route from the place of removal to that of disposal. The bidder shall state a price per cubic meter one kilometer.

68. Measurements of deposits removed from old sewers outside of necessary excavation for new work shall be by the cubic meter in carts. The bidder shall state a price per cubic meter for such excavation, which price will include refilling with clean earth or sand and hauling excavated material to a distance not more than one kilometer on the shortest practicable route. For additional distance payment shall be made as for extra haul.

69. Measurements of timber in foundation shall be per 1,000 feet B. M., actually in place, and the price bid shall include the furnishing and setting of same according to plans and specifications.

Digitized by Google

70. Measurements of piles shall be per linear meter in place, and the price bid shall be per meter and shall include the furnishing and driving of the piles according to plans and specifications.

71. Measurements of sheeting or sheet piling left in by the order of the chief engineer will be by board measure. The bidder shall state a price per 1,000 feet B. M.

PAVING.

Work to be done.

72. The work to be done consists in furnishing all labor and materials required to pave certain streets of Havana with vitrified brick and block and sheet asphalt pavements. The approximate amounts are as follows:

Preparing subgrade:			
Excavations [a]	cu. meters..	280,000	
Broken stone fill	do.....	10,000	
Rolling	sq. meters..	933,500	
Foundation, concrete	cu. meters..	93,000	
Brick pavement	sq. meters..	538,000	
Asphalt block, including brick gutters	sq. meters	395,500	
Street asphalt, including brick gutters	do...		
Standard granite curbing on sand bed	linear meters	210,000	
Standard granite curbing on concrete bed	do...		
Blue-stone curbing on sand bed	do...		
Blue-stone curbing on concrete bed	do...		
Special 8″ by 8″ granite curbing	do...		
Circular curbing of above classes	do.....	4,700	
Resetting old curbing	do.....	50,000	

As a basis for comparing bids it will be assumed that the total amount of curbing and of asphalt paving will be divided equally among the different classes and that the amount of extra haul will be 100,000 cubic meters one kilometer.

73. Preparing subgrade.—The subgrade shall be brought to an even surface parallel with the proposed finished surface of the street, according to stakes set by the representatives of the chief engineer, by the necessary excavation and embankment, and shall then be thoroughly rolled with a steam roller weighing not less than ten tons. All paving and excavated material shall be the property of the city, and, except such portions as may be needed by the contractor for filling in streets or sewer trenches, shall be promptly removed, without expense to the city, to such place as the chief engineer may direct, not distant on the shortest practicable route more than one kilometer from the point of excavation. No granite or block paving will be allowed to the contractor for any use. For hauling more than one kilometer extra payment will be made at the price bid. No earth shall be removed in the preparation of the roadway below the subgrade, and any earth taken out below such line must be replaced with broken stone without extra compensation. In all places where any filling may be required to bring the subgrade to the required height it shall be done in layers not exceeding six inches in depth and thoroughly rammed or rolled to secure a solid bed. All soft or spongy earth or other material not affording a firm foundation will be removed, and the space refilled with broken stone or other material satisfactory to the chief engineer, which shall be solidified by ramming or rolling. All shallow places, trenches, or other imperfections shall be filled with earth or stone as directed and thoroughly compacted or rolled.

It is estimated that the average depth of excavation throughout the city will be about 30 cm., but no guarantee is given as to the correctness of this figure, and the contractor is expected to examine plans and profiles and to make his own estimate of the amount of excavation.

74. Foundation.—The foundation shall be of concrete of the second class, of the thickness shown on the plans or directed by the chief engineer. The concrete shall be brought to accurate finish and grade, and such templets must be used for this purpose as may be specified by the chief engineer. The concrete must conform to the specifications given herein. It shall be kept damp until thoroughly set, and no paving, carting, or wheeling will be allowed on it before that time, and then the surface must be protected by suitable planking while hauling the wearing surface materials.

Whenever so ordered by the chief engineer, the foundation course of concrete will be omitted. In such cases the macadam surface shall be brought to accurate grade and crown, all hollows being filled with small broken stone, not more than 2″ in diameter, and the whole thoroughly rolled. No extra payment will be allowed for such work.

[a] Average depth, 30 centimeters.

Digitized by Google

75. Sand cushion and mortar bed.—Brick paving shall be laid on a sand cushion; asphalt block paving either on a sand cushion or mortar bed, as shown on the plans or directed by the chief engineer. When sand is used, it shall be of the second class as specified herein, and shall be laid to a true curve, parallel with the finished surface of the pavement, to such thickness as to insure when compacted a depth 1½ inches. The mortar bed shall be laid one inch thick, of mortar of the second class, as specified herein. Both sand cushion and mortar bed shall be surfaced by the use of such guides and templets as the chief engineer may direct.

76. Vitrified paving brick.—The bricks to be used must be of the kind known as repressed brick, and must possess such qualities as to hardness, toughness, and durability as will especially fit them for use in paving roadways. They must be thoroughly hard, well and uniformly burned, and free from warps and fire cracks. The brick must be regular in shape and uniform in size, not less than 8 nor more than 10 inches in length, not less than 4 nor more than 5 inches in depth, and not less than 2½ inches nor more than 3½ inches in thickness. The surfaces must be true, with regular edges and corner, the longitudinal edges to be rounded to a radius ⅛ to ¼ inch. The brick must show by fracture a vitrified texture and must be homogeneous and compact in structure, free from lime or magnesia or loose lumps of uncrushed clay or from other defects caused by the process of manufacture.

Samples (to the number of 50 for brick and 40 for block) proposed to be used shall be submitted by the contracter. A portion of these shall be subjected to such physical tests as the chief engineer may direct, and the remainder of those accepted shall be retained as samples of the material to be furnished and used. No brick will be accepted which does not satisfactorily meet these tests. The rattler and absorption tests shall be as follows:

Rattler test: The rattler test shall be that prescribed by the National Brick Manufacturers' Association in their convention of February, 1900. Absorption test: The rattler brick shall not absorb more than 2½ per cent of water when dried for a period of 4 hours at 212° Fahrenheit, and immersed for a period of 24 hrs.

Furthermore, no make of brick will be accepted sample blocks of which have not actually been laid in the streets of Havana and stood the test of actual wear for a period of at least three months, to the satisfaction of the chief engineer.

The brick actually furnished for use must be equal in quality to the sample furnished, and shall be subject to tests at all times.

77. Asphalt blocks.—Asphalt blocks shall be composed of crushed trap rock, granite or gneiss and asphaltic cement, as prescribed in paragraphs 80 and 85, made in the proportion of 87 to 90 per cent of stone and 10 to 13 per cent of asphaltic cement, or such other proportions as may be found by trial to be most suitable for use in Havana.

The sand and asphaltic cement shall be heated separately to about 300 degrees Fahrenheit and then mixed at the required temperature and in the required proportion in a suitable apparatus which will effect a perfect mixture.

The mixture prepared in the manner thus indicated, while hot, will be pressed into blocks 3x4x12 inches in size and then gradually cooled under water.

The bidder shall submit samples of the block he proposes to use, and the blocks furnished shall be equal in all respects to the accepted sample. The blocks will be tested for specific gravity and tensile and crushing strength. No make of block will be accepted which has not stood the test of actual wear in the streets of Havana for a period of at least three months to the satisfaction of the chief engineer.

78. Laying brick pavement.—The bricks shall be laid on edges on the sand cushion, close together, in straight lines, across the roadway, and at right angles with the line of streets. On intersection of lateral streets the bricks shall be laid at an angle of 45 degrees with the line of the street, unless otherwise ordered by the chief engineer. The joints shall be broken by a lap of half the length of the brick. Broken bricks can only be used to break joints in starting courses or making closures, but in no case will a lap of less than 3 inches be allowed. After the bricks are laid the end joints are to be made close and compact by the use of a steel bar applied at the ends next the curbs. At every fourth course, or as often as directed, the bricks are to be closed up and courses straightened in a satisfactory manner. The brick when set shall be lightly tamped under a flatter and then thoroughly rolled with a roller operated by steam power giving a weight pressure of not less than 150 or more than 250 pounds per linear inch of roller, the rolling to continue until the bricks are firmly bedded and the pavement surface is perfectly true and smooth and to the proper grade and crown. Any portion of the pavement not accessible to the roller will be thoroughly rammed two or more times, as the chief engineer may direct. After rolling or ramming all broken and chipped brick must at once be removed and replaced by sound and perfect brick. The joints or spaces between the bricks shall be filled about ½ with sand and the remainder with coal tar residuum paving cement,

Digitized by Google

ordinarily numbered 6 at the manufactory, heated in a closed cauldron to a temperature of 300 degrees Fahrenheit, or entirely filled with cement, as directed by the chief engineer. A second pouring shall be required if in the opinion of the chief engineer the first pouring has not completely filled the spaces; the pavement must be thoroughly dry before the joints are filled. After the spaces between the bricks have been filled, the surface of the pavement shall then receive a one-half inch dressing of clean sand.

79. Laying block asphalt pavement.—The asphalt blocks shall be laid close together in straight lines across the roadway and at right angles to the line of street, and care must be taken to have the wearing surface up. At intersection of lateral streets, the blocks shall be laid at an angle of 45 degrees with the line of the street, unless otherwise ordered by the chief engineer. The joints shall be broken by a lap of one-third of the length of the block. Broken blocks can only be used to break joints in starting courses or making closures, but in no case shall less than one-third of a block be used. After the blocks are laid, the end joints are to be made close and compact by the use of a steel bar applied at the ends next curbs. At every fourth course, or as often as directed, the blocks are to be closed up and courses straightened in a satisfactory manner. When laid on sand cushion, the blocks when set shall be lightly tamped under a flatter, and then thoroughly rolled with a steam roller giving a weight pressure of not less than 150 or more than 250 pounds per lineal inch of roller, the rolling to continue until the blocks are firmly bedded and the pavement surface is perfectly true and smooth and to crown and grade. Any portion of the pavement not accessible to the roller must be thoroughly rammed 2 or more times as the chief engineer may direct. After rolling, all broken or damaged blocks must at once be removed and replaced by sound and perfect blocks.

When laid on a mortar bed, the blocks after being set shall be well settled and made firm before the mortar sets by ramming under a flatter with a rammer weighing not less than forty pounds, to a uniform and smooth surface, in conformity with the crown and grade of the street.

The joints or spaces between the blocks shall be filled with grout made of sand cement, composed of equal parts of Portland cement and silicious sand ground together. A second pouring shall be required if, in the opinion of the chief engineer, the first pouring has not completely filled the spaces.

Sheet asphalt pavement.

80. Quality of asphalt.—The asphalt used shall be of best quality refined asphalt from Trinidad Lake, island of Trinidad, Bermudez, Venezuela, or Alcatras from California. No asphalt known as "land asphalt" or "rock asphalt" will be used. No asphalt paving shall be done by any company or individual which has not laid pavements composed of the materials to be used in Havana, which have stood in good condition under traffic for at least two years.

Should the contractor desire to use Cuban asphalt for paving he will be allowed to pave a street not less than 500 meters in length, to be selected by the chief engineer, as a test pavement. This pavement will not be accepted and no payment therefor will be made until it has been subjected to traffic for one year. If at the end of that period it has proved satisfactory in all respects to the chief engineer, the contractor will be allowed to lay similar pavements to a total of not to exceed 75,000 square meters. Should any of the pavements laid with Cuban asphalt prove at any time within five years from the date of acceptance less durable or resistant in the opinion of the chief engineer than similar pavements laid with any of the standard asphalts herein specified, the contractor will, upon the order of the chief engineer, remove all the pavements of Cuban asphalt at his own expense and substitute pavements of one of the standard asphalts herein specified. This condition shall be binding upon the contractor in every way, and observance and compliance secured by his bond and retained payments.

81. Binder.—The binder course shall be composed of clean, broken stone equal in quality to the stone for the base and passing an inch and a quarter screen. Eighty-five per cent of this shall pass in its longest dimensions, and of the remaining fifteen per cent no piece shall have a larger dimension than two (2) inches, and the stone after passing the heating drums shall not contain less than five nor more than fifteen per cent of material passing a No. 10 screen.

The stone shall be heated not higher than 350 degrees F., in suitable appliances. It is then to be thoroughly mixed by machinery with asphalt cement, such as is acceptable for surface cement, at 300 degrees to 325 degrees F., penetration 60 degrees to 90 degrees, District of Columbia standard, in such proportions that the resulting binder will have life and gloss without an excess of cement. Should it appear dull

Digitized by Google

from overheating or lack of cement, it will be rejected. While hot it will be hauled upon the work, spread upon the base so that when compacted it will be at least one and one-half inches in thickness, and immediately rammed and rolled until it is cold. Should the resulting course not show a proper bond it shall be immediately removed and replaced by the contractor.

The contractor shall not enter upon a concrete base in order to lay the binder course until, in the opinion of the chief engineer, it has obtained sufficient strength for such purpose, and during the period between laying base and binder he shall properly protect it, and when ordered by the chief engineer shall sprinkle it as often as may be deemed necessary.

82. Asphalt surface.—The surface shall be made and laid according to the following specifications: The materials which shall be used therefor are: 1, asphalt; 2, heavy petroleum oil or other softening agent; 3, sharp, clean, silicious river sand; 4, fine inorganic dust.

83. Asphalt.—The crude asphalt shall be refined until homogeneous and free from water. It shall not at any time reach a temperature high enough to injure it.

84. Heavy petroleum oil.—The oil in use in the manufacture of asphalt cement shall be a petroleum or other softening agent approved by the chief engineer. If petroleum, it must be one from which the lighter oils have been removed by distillation without cracking, until the oil has the following characteristics: Flash point, not less than 300 degrees F., distillate at 400 degrees for thirty hours, less than 10 per cent. The flash point shall be taken in a New York State closed oil tester. The distillate shall be made with about 50 grammes of oil in a small glass retort provided with a thermometer and packed entirely in asbestos. The residue in the retort after distilling must be fluid at 75 degrees F., and not coarsely crystalline on cooling.

85. Asphaltic cement.—When the refined asphalt is not already of the proper consistency, the cement shall be prepared by tempering refined asphalt with heavy petroleum oil or other approved softening agent complying with the above specifications (at a temperature between 250 degrees and 350 degrees F.). Its penetration must be within the range of 40 degrees and 60 degrees, District of Columbia standard of hardness, and will be fixed by the chief engineer.

The asphalt cement must never be heated to a temperature exceeding 350 degrees Fahrenheit.

Where asphaltic cement containing over 10 per cent of foreign material is kept in storage, it must be thoroughly agitated when used, as must also all dipping kettles while in use.

Sample of the asphaltic cement and of the petroleum oil shall be supplied to the inspector of asphalt and cement when required, and in suitable tin boxes and cans.

86. Sand.—The sand shall be silicious, hard grained, and moderately sharp. On sifting, it should have at least 15 per cent of material that would be caught on a 40 mesh per inch screen, 25 per cent of material that will pass an 80 mesh to the inch screen, 10 per cent of which at least must pass a 100 mesh to the inch screen. If the sand to be used does not contain the desired fine material, limestone dust or other suitable material can be added to make up the deficiency.

87. Inorganic dust.—This shall be any inorganic dust not acted upon by water, the whole of which shall pass a 30-mesh screen, and at least seventy-five per cent pass a 100-mesh screen.

88. Asphalt paving mixture.—The materials complying with the above specifications shall be mixed in proportions by weight, depending upon their character and the traffic on the street, and upon the character of the asphalt, and will be determined by the chief engineer, but the percentage of bitumen in any mixture soluble in carbon bisulphide shall not exceed the limits, 9 to 13 per cent. If the proportions of the mixture are varied in any manner from those specified, the mixture will be condemned; its use will not be permitted, and if already placed on the streets it will be removed and replaced by proper materials at the expense of the contractor.

The sand or the mixture of sand and stone dust and the asphaltic cement will be heated separately to about 300 degrees Fahrenheit. The dust, if limestone, will be mixed while cold with the hot sand in the required proportions and then mixed with the asphaltic cement at the required temperature and in the proper proportions in a suitable apparatus, so as to effect a thoroughly homogeneous mixture. Sand boxes and asphalt gauges will be weighed in presence of inspectors as often as may be desired, and all samples desired shall be supplied in suitable boxes to the inspector of asphalt and cement, and he shall have access to all branches of the work at all times.

The pavement mixture prepared in the manner thus indicated will be brought to the ground in carts at a temperature of not less than 250 degrees or more than 350 degrees Fahrenheit. It will then be thoroughly spread to a thickness of two and

Digitized by Google

one-half (2½) inches by means of hot iron rakes in such manner as to give uniform and regular grade, so that, after having received its ultimate compression of about two-fifths, it will have a net thickness of at least one and one-half (1½) inches. This depth will be constantly tested by means of gauges furnished by the chief engineer. The surface will then be compressed by hand rollers, after which a small amount of hydraulic cement will be swept over it, and it will then be thoroughly compressed by a steam roller weighing not less than 175 pounds to the inch run, the rolling being continued for not less than five hours for every 1,000 yards' surface.

89. Gutters.—Brick gutters, at least two bricks in width, shall be laid on all streets paved with sheet asphalt or asphalt block.

90. Curbing.—Proposals will be received for three forms of curbing, i. e., standard granite, special 8 x 8 inch granite, and bluestone. Standard granite curb must be of good and acceptable texture and color, dressed 12 inches on the face, 5 inches on the back, and chiselled 6 inches deep on the joints, with no projections beyond the chiselled portion of the joint; the joint to be at right angles to the face and top surface; the top surface to be bevelled ¼ inch; the face and top to be plane surfaces, without depressions or irregularities. The length must not be less than 6 feet, depth not less than 20 inches nor more than 24 inches in any portion of a piece, and thickness 6 inches. The bed of the curb must average not less than 6 inches in width, and no excessive protuberance will be allowed on the sides. Special 8 x 8 inch granite curb must be of suitable and acceptable color and texture, dressed on top and the full depth on the face, and 5 inches deep on back. The top surface shall be bevelled ¼ of an inch. The face and top must be plane surfaces, without bends, twists, depressions, cups, or other irregularities. It will be 8 inches thick, not less than 8 inches nor more than 12 inches deep, and no piece less than 6 feet long. The joint shall be chiselled throughout.

The bed shall be rough dressed to give secure bearing. Bluestone curb shall be best North River bluestone, dressed 12 inches on the face and 5 inches on back, and chiselled 6 inches deep on the joints, with no projection beyond the chiselled portion of the joint; the joints to be at right angles to the face and top surface. The top surface will be bevelled ¼ of an inch; the face and top to be plane surfaces, without bends, twists, depressions, cups, or other irregularities. The length must not be less than 4 feet, depth not less than 20 inches and not more than 24 inches, in any portion of a piece, and thickness 5 inches. Each piece must have a bed not less in area than the dressed portion of the curb, and no excessive protuberance on the sides.

All curbing shall be set to lines and grades as furnished by the engineer, with close-fitting joints, in good workmanlike manner. Curbs cut to a radius of 4 feet or with such radii as the chief engineer may designate shall be set at the corners of the streets. Unless otherwise designated on plans or ordered by the chief engineer, the standard granite or bluestone curb shall be set in a depth of not less than 5 inches of clean sand or fine crushed rock, and backed up with not less than 5 inches of the same material to within 6 inches of the top of the curb. When directed by the chief engineer or designated on plans the curbs shall be set on a bed of concrete, which shall be, after thorough consolidation, 5 inches deep over the bottom of the trench excavated to the proper depth, and shall be connected with the concrete base of the paving adjoining, should such base be concrete. The concrete shall also be continued up behind the curb, within 6 inches of its top, and shall be nowhere less than 5 inches in width, regardless of excess of width of curbing. The special granite curb will always be set in concrete, as described above. The work of setting this curb shall be done by competent stonemasons, and especial care must be taken to have it securely bedded.

The bidder must submit samples of the granite or bluestone he proposes to use; and all curb used shall be equal in quality to the accepted sample.

91. Resetting old curb.—Where required by the chief engineer, the old curb now in place shall be removed, re-dressed and reset to grade and line according to the specifications for laying new curb. Otherwise it shall be realigned and brought to grade without removing it from its place. This shall be done by the contractor at his own expense.

92. Restoring sidewalks.—Wherever the sidewalk pavement is disturbed to set, reset, or straighten curb, it must be replaced by the contractor, at his own expense, in as good condition as before removal.

93. Existing structures.—All the general provisions and requirements stated in these specifications under the heading "Sewerage system," such as maintaining pipes and underground structures in repair, responsibility for damages of any kind, keeping sidewalks and adjacent parallel and cross streets open, disinfection, etc., shall be equally applicable to the work of street paving, except that the length of street occupied by

Digitized by Google

the contractor for street paving may be three hundred meters. All water, gas, and other pipe mains and house connections thereto shall, if necessary, be lowered by the contractor at his own expense. No paving shall be laid until the backfill over sewers and drains has thoroughly settled, and any paving which settles after laying shall be taken up and relaid by the contractor at his own expense. No pavement will be considered in good repair and hence accepted at the expiration of the guarantee period unless the paving material is sound and the wearing surface of the roadway is 75 per cent in thickness of the specified depth of the original paving and in a smooth condition for travel.

94. Measurements and payments.—Measurements of subgrade preparation shall be by the square meter, and the price bid therefor must include all excavation and embankment, and all labor and materials required to prepare the subgrade according to plans and specifications.

Measurement of extra haul shall be per cubic meter in carts, and per kilometer on the shortest practicable route to the point of disposal. The bidder shall state a price per cubic meter per kilometer.

Measurement of concrete foundation shall be by the cubic meter in place. The bidder shall state a price per cubic meter, this price to include all labor and materials required to lay the concrete according to plans and specifications.

Measurement of brick and block and sheet asphalt paving shall be per square meter. The bidder shall state a price per square meter for brick paving, for asphalt block paving on sand cushion, for asphalt block paving on mortar bed, and for sheet asphalt paving, which prices shall include all labor and materials necessary for laying these pavements according to plans and specifications.

Measurement of curbing shall be per linear meter on the upper outside face, as set complete in place. The bidder shall state separate prices per linear meter for standard granite curbing on sand and concrete beds; for bluestone curbing on sand and concrete beds; for 8″ x 8″ granite curbing; for resetting old curbing on sand and concrete beds; these prices to include all labor and materials required to place the curbs according to plans and specifications.

PROPOSAL FOR SEWERAGE SYSTEM AND STREET PAVING, CITY OF HAVANA.

——— ———,
——— ———, 1901.

To the MAYOR OF HAVANA, *Havana, Cuba.*

SIR: In accordance with your advertisement of February 23, 1901, inviting proposals for the sewerage system and street paving, city of Havana, and subject to all the conditions and requirements thereof, and of your specifications, dated February 23, 1901, copies of both of which are hereto attached, and, so far as they relate to this proposal, are made a part of it, we (or) I propose to furnish all labor, material, and appliances required by the specifications, to perform the work indicated therein, and to maintain said work in repair as specified for the unit prices given below.

The total amount of this, our bid, computed from such unit prices, with the approximate quantities named in the specifications herewith, is ——— ——— ($——— ———) U. S. currency.

SEWERAGE SYSTEM.

East side marginal system.

SECTION 1.

For the construction of all 8-inch sewer the sum of ——— ——— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of ——— ——— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of ——— ——— ( ) per linear meter.
For the construction of all 48-inch sewer the sum of ——— ——— ( ) per linear meter.
For the construction of all 54-inch sewer the sum of ——— ——— ( ) per linear meter.
For the construction of all 18-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 20-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 24-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 28-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 32-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 34-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 36-inch drain the sum of ——— ——— ( ) per linear meter.
For the construction of all 38-inch drain the sum of ——— ——— ( ) per linear meter.

Digitized by Google

East side marginal system.

SECTION 2.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.

East side marginal system.

SECTION 3.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.

East side marginal system.

SECTION 4.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— ——.

East side marginal system.

SECTION 5.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.

East side marginal system.

SECTION 6.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch drain the sum of —— —— ( ) per linear meter.

Digitized by Google

East side marginal system.

SECTION 7.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 46-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 58-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 62-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 64-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 66-inch drain the sum of —— —— ( ) per linear meter.

North side marginal system.

SECTION 1.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 82-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 84-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 114-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 54-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 60-inch drain the sum of —— —— ( ) per linear meter.

North side marginal system.

SECTION 2.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 82-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 46-inch drain the sum of —— —— ( ) per linear meter.
For the consrruction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 62-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 66-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 68-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 78-inch drain the sum of —— —— ( ) per linear meter.

North side marginal system.

SECTION 3.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 80-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 82-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 52-inch drain the sum of —— —— ( ) per linear meter.

Digitized by Google

North side marginal system.

SECTION 4.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 80-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 48-inch drain the sum of —— —— ( ) per linear meter.

North side marginal system.

SECTION 5.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 78-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 54-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 58-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 60-inch drain the sum of —— —— ( ) per linear meter.

North side marginal system.

SECTION 6.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 58-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 70-inch sewer tunnel the sum of —— —— ( ) per linear meter.
For the construction of all 74-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 48-inch drain the sum of —— —— ( ) per linear meter.

South side high-level system.

SECTION 1.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.

Digitized by Google

South side high-level system.

SECTION 2.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 64-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.

South side high-level system.

SECTION 3.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 64-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 66-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 70-inch tunnel the sum of —— —— ( ) per linear meter.
For the construction of all 70-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 74-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch drain the sum of —— —— ( ) per linear meter.

North matadero system.

SECTION 1.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 52-inch drain the sum of —— —— ( ) per linear meter.

North matadero system.

SECTION 2.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 58-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 72-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 80-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 82-inch drain the sum of —— —— ( ) per linear meter.
For the construction of all 84-inch drain the sum of —— —— ( ) per linear meter.

Digitized by Google

North matadero system.

SECTION 3.

For the construction of all 8-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 30-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 40-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain, the sum of —— —— ( ) per linear meter.

Matadero drainage system.

For the construction of all 24-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 42-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 46-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 48-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 58-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 68-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 70-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 82-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 84-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 140-inch drain, the sum of —— —— ( ) per linear meter.
For the construction of all 16 by 10 foot drain, the sum of —— —— ( ) per linear meter.
For the construction of all 18 by 9½ foot drain, the sum of —— —— ( ) per linear meter.
For the construction of all 20 by 9½ foot drain, the sum of —— —— ( ) per linear meter.

South Matadero system.

SECTION 1.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12 inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch sewer, the sum of —— —— ( ) per linear meter.

South Matadero system.

SECTION 2.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer, the sum of —— —— ( ) per linear meter.

Jesus del Monte system.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 24-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 34-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 38-inch sewer, the sum of —— —— ( ) per linear meter.

Cerro system.

SECTION 1.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 50-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 52-inch sewer, the sum of —— —— ( ) per linear meter.

Cerro system.

SECTION 2.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 52-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 54-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 62-inch sewer, the sum of —— —— ( ) per linear meter.

Digitized by Google

Cerro system.

SECTION 3.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer, the sum of —— —— ( ) per linear meter.

Cerro system.

SECTION 4.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.

Cerro system.

SECTION 5.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer, the sum of —— —— ( ) per linear meter.

Vedado system.

SECTION 1.

For the construction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 44-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 54-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 56-inch sewer, the sum of —— —— ( ) per linear meter.

Vedado system.

SECTION 2.

For the corstruction of all 8-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 12-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 15-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 18-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 26-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 28-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 32-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch sewer, the sum of —— —— ( ) per linear meter.
For the construction of all manholes of the first class, the sum of —— —— ( ) each.
For the construction of all manholes of the second class, the sum of —— —— ( ) each.
For the construction of all manholes of the third class, the sum of —— —— ( ) each.
For the construction of all manholes of the fourth class, the sum of —— —— ( ) each.
For the construction of all manholes of the fifth class, the sum of —— —— ( ) each.
For the construction of all manholes of the sixth class, the sum of —— —— ( ) each.
For the construction of all No. 1 receiving inlets, the sum of —— —— ( ) each.
For the construction of all No. 2 receiving inlets, the sum of —— —— ( ) each.
For all cast iron in drain outfalls, the sum of —— —— ( ) per ton of 2,000 pounds.
For the construction of all 6-inch vitrified-pipe house connections for sewers, the sum of —— —— ( ) per linear meter.
For the construction of all 6-inch cast-iron-pipe house connections for sewers, the sum of —— —— ( ) per linear meter.
For the construction of all 6-inch ventilator pipes, the sum of —— —— ( ) per linear meter.
For the construction of all 6-inch house connections for drains, the sum of —— —— ( ) per linear meter.
For the construction of all 10-inch inlet connections to drains, the sum of —— —— ( ) per linear meter.
For the construction of all 36-inch force main, the sum of —— —— ( ) per linear meter.
For the construction of all 20-inch force main, the sum of —— —— ( ) per linear meter.
For the furnishing and placing of all 36-inch valves, the sum of —— —— ( ) each.
For the furnishing and placing of all 20-inch valves, the sum of —— —— ( ) each.
For the construction of the siphon on Infanta street at Villarin bridge, the sum of —— —— ( ).
For the construction of the siphon on Concha street, the sum of —— —— ( ).
For the construction of the siphon across Matadero Creek near Cristina Bridge, the sum of —— —— ( ).
For the construction of the South Side pumping station, the sum of —— —— ( ).
For the construction of the Vedado pumping station, the sum of —— —— ( ).
For the construction of the Vedado sublift corner Fifth and B streets, the sum of —— —— ( ).
For the construction of the Vedado sublift corner Seventh and Sixteenth streets, the sum of —— —— ( ).
For the construction, maintenance, and operation of the sand catcher, settling basins, temporary pumping station, and outfall at La Punta, the sum of —— —— ( ).
For the construction of the siphon across the harbor at La Punta, the sum of —— —— ( ) per linear meter.

Digitized by Google

Vedado system—Continued.

SECTION 2—Continued.

For the construction of El Morro pumping station, the sum of —— —— ( ).
For the construction of all 7-foot tunnel in outfalls, the sum of —— —— ( ) per linear meter.
For the construction of all 7-foot sewer in outfall, the sum of —— —— ( ) per linear meter.
For the construction of the outfall well, the sum of —— —— ( ).
For the construction of the offshore outfall sewer, the sum of —— —— ( ) per linear meter.
For all extra earth excavation, the sum of —— —— ( ) per cubic meter.
For all extra rock excavation, the sum of —— —— ( ) per cubic meter.
For all extra rubblestone masonry, the sum of —— —— ( ) per cubic meter.
For all extra second-class concrete masonry, the sum of —— —— ( ) per cubic meter.
For all extra haul, the sum of —— —— ( ) per cubic meter 1 kilometer.
For all excavation of deposits from old sewers, the sum of —— —— ( ) per cubic meter.
For all extra haul of material excavated from old sewers, the sum of —— —— ( ) per cubic meter 1 kilometer.
For all timber in foundation, the sum of —— —— ( ) per 1,000 feet B. M.
For the furnishing and driving of all piles, the sum of —— —— ( ) per linear meter.
For all sheathing left in trench, the sum of —— —— ( ) per 1,000 feet B. M.
For all sheet piling left in place, the sum of —— —— ( ) per 1,000 feet B. M.

Street paving.

For preparing subgrade, the sum of —— —— ( ) per square meter.
For extra haul, the sum of —— —— ( ) per cubic meter one kilometer.
For concrete in foundation, the sum of —— —— ( ) per cubic meter.
For brick pavement, including sand cushion, the sum of —— —— ( ) per square meter.
For block asphalt pavement on sand cushion, including cushion, the sum of —— —— ( ) per square meter.
For block asphalt pavement on mortar bed, including bed, the sum of —— —— ( ) per square meter.
For sheet asphalt pavement, the sum of —— —— ( ) per square meter.
For standard granite curbing on sand bed, including bed, the sum of —— —— ( ) per linear meter.
For standard granite curbing on concrete bed, including bed, the sum of —— —— ( ) per linear meter.
For bluestone curbing on sand bed, including bed, the sum of —— —— ( ) per linear meter.
For bluestone curbing on concrete bed, including bed, the sum of —— —— ( ) per linear meter.
For special 8″ x 8″ granite curbing, including bed, the sum of —— —— ( ) per linear meter.
For circular standing granite curbing on sand bed, including bed, the sum of —— —— ( ) per linear meter.
For circular standard granite curbing on concrete bed, including bed, the sum of —— —— ( ) per linear meter.
For circular standard bluestone curbing on sand bed, including bed, the sum of —— —— ( ) per linear meter.
For circular standard bluestone curbing on concrete bed, including bed, the sum of —— —— ( ) per linear meter.
For circular special 8″ x 8″ granite curbing, including bed, the sum of —— —— ( ) per linear meter.
For resetting old curbing on sand bed, including bed, the sum of —— —— ( ) per linear meter.
For resetting old curbing on concrete bed, including bed, the sum of —— —— ( ) per linear meter.

We (or) I make this proposal with a full knowledge of the kind, quantity, and quality of the articles required, and if it is accepted will, after receiving written notice of such acceptance, enter into contract within the time designated in the specifications, with good and sufficient sureties for faithful performance thereof.

[Signature] ——— ———.
[Address] ——— ———.
[Signature] ——— ———.
[Address] ——— ———.
[Signature] ——— ———.
[Address] ——— ———.
[Signed in triplicate.]

WORKS OF THE PORT.

The operations of the division of the "works of the port" (see report of A. H. Weber, assistant engineer) during the past six months have been confined mainly to work of a routine character, the only exception being the construction of a small concrete bulkhead and steps in front of the building used by the captain of the port. The plant of this division has been most usefully employed on work for private owners on the water front, for which these owners have paid in full. This use of the public plant was necessitated by the absence of any private plant for work of this character in these waters.

The project of improving the harbor front of Habana between the Punta and Caballería Wharf as given in Captain Weber's report would result in great benefit to the city. In addition to the sanitary and economical advantages which would result therefrom, this work in connection with the new park to the west of the

Digitized by Google

punta and the proposed sea wall and roadway between it and the torreón at San Lazaro will give to Habana a sea-front driveway and promenade second in beauty to none in the world.

Attention is invited to the report on the tidal observations at Habana. It will be noted that there is little variation between the range and time of the tides of the Gulf (Straits of Florida) outside of the harbor and the range at the head of the harbor. The mean range for the year of the Gulf gauge was 0.898 feet; the maximum 2.22 feet, and the minimum 0.02 feet. The maximum difference of water level observed was 3.07 feet. The observations will be continued for some time longer. The establishment of the port, deduced from one year's observations, is 8 hours and 14 minutes.

Captain Weber has acted also in the general capacity of assistant to the chief engineer of the department, and has made a number of valuable investigations and reports on works throughout the island.

The pressing need for increased wharf facilities continues. As detailed in the report of the department for the fiscal year 1900, page 142, the available spaces in the immediate city front which are not adequately utilized comprise 370 meters lying between the ferry steps and the San José concession wharves; about 350 meters of the San José concession front; about 250 meters of the navy-yard front, and the 550 meters front which can be gained by dredging and bulkheading at the head of the bay between the gas company's wharves and the point of Atarés hill. If these spaces were utilized and piers built projecting from them, as well as from the 593 meters front of the general merchandise wharves owned by the State, provision would be made for the commerce of the city for many years.

The construction of piers has in the past been discouraged partly by the owners of lighters in the harbor, who make large profits from their plant, and partly by quarantine restrictions in the States. The quarantine regulations, particularly of the Southern States, impose penalties on vessels which lay at the wharves of Habana additional to those to which ships which simply anchored in the harbor are subjected. It is to be expected that, now that a greater knowledge has been gained of the nature and mode of propagation of yellow fever, the regulations will be changed.

The substantiation of the mosquito theory of the propagation of yellow fever makes more urgent the necessity for bulkheading and filling at the head of the bay, for in the rainy season there is enough fresh water in the marshes there to permit moequitoes to breed.

With a continuous line of bulkhead from the Punta to Regla, with the sewage of Habana carried to sea as contemplated in the contract about to be entered into by the city of Habana, with the waters of Matadero Creek purified by the removal of the abattoir and freed from sewage, and with the streets of Habana kept clean as at present, the stigma which has so long rested on the harbor of Habana must be removed. Even now, with the systematic street cleaning and removal of refuse around the harbor, the waters compare in purity favorably with those of the harbors of many northern commercial ports, and during the past year, which has had the characteristics of a "yellow fever year," the section of the city lying along the water front has suffered less than the portions of the high central part.

BUILDING CONSTRUCTION AND REPAIR.

The repair of the various public buildings in the vicinity of Habana and their adaptation to modern requirements has caused a very large amount of work, the details of which are given in the report of Captain Huston.

As stated earlier, all construction and repair work with which this department was charged, whether municipal or State, has been carried on by the same force. Capt. T. L. Huston, assistant to the department chief engineer, was placed in general charge, and took personal supervision of the conduct of the works, in addition to his office duties in planning and estimating, while the office part of the work was more directly supervised by Mr. G. W. Armitage, architect of the city engineer's force. Mr. Armitage had particular charge of designing and drafting. In addition to the ordinary building construction work, this office was charged with a considerable amount of work which would ordinarily be classed as mechanical and electrical engineering, in the design and installation of electric lighting, laundry, and steam cooking plants. The work has been done in a manner satisfactory to all concerned, and great credit is due to the entire division for their skill and energy. It is a matter of pride that in the work done by hired labor the estimates were found to be close and correct, and in the contract work the contract price was in general in excess of the estimated cost by a margin equal to or greater than that usually allowed for contractors' profits and contingencies. How much technical knowledge this demon-

Digitized by Google

strates can only be appreciated by those who have had experience in remodeling and fitting old buildings.

Attention is invited to Captain Huston's report, which is very detailed and which contains information of value to all who are interested in the work of the United States in Cuba as well as to all who in future will have charge of similar work in this island.

Extensive use has been made of expanded metal construction on wire frames or wooden frames. Toilet-room partitions made in this way on iron frames have the neat, solid appearance of slate or marble and are cheaper. Examples of this construction can be seen in the illustrations accompanying the report on the Dragones Barracks work.

In expanded metal work partitions the studding must not be spaced more than 12 inches apart. The expanded metal must be drawn tight and the laps carefully wired together. The first coat of plaster is applied in the consistency of ordinary mortar and in quantity sufficient to form a comparatively smooth surface about three-eights of an inch thick over the outside face of the expanded metal. Before setting it is scratched thoroughly with the stub of a broom. The first coat is made as follows: A mortar of 1 part lime putty and 2 parts sand is made in quantity sufficient for the entire job. This should be mixed at least two weeks before using. As required, this mortar is mixed with Portland cement in the proportion of 1 part cement and 3 parts mortar, and thinned with water to the required consistency. Six hours after the first coat has been applied the finish coat is applied. This finish coat is made of the lime mortar previously described mixed with an equal quantity of Portland cement and thinned with water. This coat must be thoroughly rubbed in with a float until the mortar has taken a first set, rubbing out the small cracks which develop, as the setting begins when the surface is exposed to the sun.

It is believed that this department is the first to use this method of construction in Cuba. It has proved economical and as far as can now be determined, durable. In this climate, where masonry is expensive, where wood is quickly destroyed by insects, and where hollow walls are desirable as nonconductors of heat, it would seem to be particularly advantageous.

In utilizing the ordinary type of tank water-closet for school or prison work, Mr. Armitage made a most useful improvement by inclosing the chain for the pull in an iron pipe, and substituting a simple lever, working through a slot in the pipe, for the pull handle. By this means the chain is protected against accident or malice and the pull in the lever is always in the right direction.

In the preparation of the Mercedes Hospital operating room all possible precautions have been taken for the protection of the patient, as detailed in Captain Huston's report.

The execution of the project was attended with difficulties of all kinds. In glass plates for the floor the edges were untrue and the surfaces were warped. These edges had to be ground to true plane surfaces on an emery wheel, and after laying the top surfaces had to be rubbed down at the joints by hand with emery powder and a soft lead tool. Holes three-fourths of an inch in diameter were bored through the glass to permit the introduction of the foot hot and cold water and discharge valves for the surgeon's hand basins. These were made by hand drilling with a point made from a taper, three-cornered file, lubricated with water, oil and turpentine having proved unsatisfactory. When the glass and iron skylight was placed, many leaks developed in the joints between the glass and iron under the heavy rains which occur in this latitude. After the ordinary means of stopping the leaks had failed, a coat of paraffin in the joints proved entirely successful. The filter for the air is simple and promises to be effective.

In the work at the laboratories the only process at all novel was the finish of the tops of the operating desks. It was desirable that these should be of a dull black color, and rendered proof against acids. The process described in Captain Huston's report was suggested by a similar finish which has been in use for some years in the laboratories of the College of Physicians and Surgeons of New York. Much of the furniture is also modeled after the designs in use there. This office is indebted to Dr. John Woodbury, of New York, and to the officials of these laboratories for much valuable information regarding laboratory fittings.

In all of the buildings, as well as in the park work, concrete has been used very successfully for pavements and floors.

The concrete for floors and pavements was 3½ inches in thickness, composed of a base 3 inches thick, of ordinary concrete of 1 part Portland cement, 4 parts sand, and 8 parts broken stone, with a top finish one-half inch thick, of 1 part Portland cement and 1 part sand. The base was laid in beds 6 feet wide by any convenient length. This was then cut through with a hatchet along lines at right angles to each other

Digitized by Google

so as to divide the entire bed into blocks about 3 feet square. The cuts were then filled with sand and the ends of the cuts carefully marked. The wearing surface was then applied (which must be before the concrete in the base has set) and well rubbed in and floated on top to a true surface. A score about one-fourth inch in depth was then ruled in the wearing surface directly over the cuts in the base. Planes of weakness were formed in this manner, so that the cracks which are sure to form in a large mass of concrete appeared as hair lines in the scores, and were not unsightly. The application of the wearing surface before the base has set and the proper formation of these planes of weakness are essential to the formation of a strong, well-appearing pavement. Difficulty was experienced in training the working parties to follow these instructions, and wherever they were deviated from defects appeared later in the pavement.

The cost in Habana of pavements of this character is given in the following table (per square of 100 square feet):

MATERIAL.

Finish coat or wearing surface:		
1.16 barrels Portland cement, at $3.40	$3.94	
1.16 barrels sand, 4 cubic feet, at $0.06	.25	
Total cost material of finish coat		$4.18
Concrete base:		
25 cubic feet stone, at $0.06	1.50	
12½ cubic feet sand, at $0.06	.75	
0.95 barrel (3.1 cubic feet) cement, at $3.30 per barrel	3.14	
Total cost material for concrete base		5.39
Total cost of material		9.57
Total cost material per square yard		.86
Total cost material per square meter		1.03

LABOR.

Finish coat or wearing surface:		
1 mason at $3, 1 mason at $2.50, $5.50, for 2½ hours or 11/16 of a day	1.54	
Foreman	.50	
Total cost labor on wearing surface		2.04
5 laborers at $1.25, 2 laborers at $1 for one-fourth day	2.06	
Foreman for one-fourth day	.50	
Total cost labor, concrete base		2.56
Total cost of labor per square (100 square feet)		4.60
Total cost of labor per square yard		.41
Total cost of labor per square meter		.49
Total cost of completed pavement:		
Per square (100 square feet)		14.17
Per square yard		1.27
Per square meter		1.52

NOTE.—A mason will lay on an average about 200 square feet of finish coat per day.

The roof of the court room of the municipal vivac is to be of concrete and expanded metal, on steel I beams, spaced 5 feet apart, as detailed in Captain Huston's report. The concrete will be finished as detailed for pavements. To allow for expansion and contraction, joints three-fourths inch wide, filled with paving pitch, will be placed over a number of the I beams, so as to divide the roof into sections about 20 by 20 feet. The surface of the concrete will be coated with paraffin, applied hot (one-third paraffin and two-thirds kerosene), to make it waterproof.

In the repair work at the carcel a number of the old sewers were dug up. These were in a very foul condition and extraordinary care had to be taken in the disinfection of the openings and of the materials removed. It is gratifying to the department to be able to state that no sickness resulted from this work among the employees of the department or in the crowded prison.

SURVEY OF VICINITY OF HABANA.

An accurate survey has been made of batteries 1, 2, 3, 4, 5, and Velasco, which are all of the modern works, excepting the small addition to the old fort of La Punta, for the sea-coast defense of Habana. The Spanish plans of the works, received through the evacuation commission, were found to be inaccurate, and were probably the original projects which were deviated from in construction. Photographs have been taken of all parts of the works. Surveys of El Moro and Atarés have been partly completed.

The topographical survey of the country in the vicinity of Habana is in progress, and the field work over the area between Habana Harbor and the Almendares River

Digitized by Google

has been completed and the work partly plotted for a distance of about 3½ miles from the coast. This work is tied to the accurate survey of the city, made by the street division of the city engineer department.

The most difficult part of the territory around Habana has been covered and greater apparent progress will be made in the next few months.

Mr. Sargent's force was badly crippled and the work delayed by the yellow fever of the past summer, but only one man was stampeded thereby. For details of the work attention is invited to Mr. Sargent's report.

In general it may be said that the city engineer department has proved well organized for its work. A change which should be made in the near future is to organize a plumbing inspector's office as a part of the office of the municipal architect. This has not been done inasmuch as new legislation is required to make it effective. The time did not seem ripe for a modern plumbing law in this city until this winter. At last the citizens of Habana have recognized the necessity for this and a commission has been named by the military governor for the consideration of the entire subject.

The military governor has taken active interest in the work in Habana, and as far as revenues would permit, has made appropriations for the works for the sanitation and beautification of the city, for the reconstruction and modernizing of its buildings for public uses, and for the care and preservation of the relics of its stormy past, which yet remain in the portions of the city wall and the ancient works of fortification.

My thanks are due to Lieutenant Barden and his assistants, and to the assistants of the chief engineer of the department for a faithful and interested performance of duty under the very onerous conditions which prevail in Habana for the officials of the government of intervention.

APPENDIX A.

PUERTO PRINCIPE, CUBA, *February 19, 1901.*

SIR: Complying with instructions, I have the honor to submit the following report on expenditures of customs-funds appropriation, military department, administration and rural guard, fiscal year 1901, for the period July 1 to December 31, 1900.

The amount of money received from the treasurer is stated below:

July	$9,568.50
August	9,780.50
September	9,583.75
October	10,681.48
November	10,108.75
December	8,844.86
Total	58,567.84

The expenditures were, as stated under the following heads:

I. Pay of rural guard: The rural guard paid by this office consists of 6 officers, 26 noncommissioned officers, and 162 privates, all mounted.

Expenditures:	
Pay rolls paid	$42,075.00
Liabilities	8,018.65
Total	50,093.65

II. Watchmen: Two watchmen are employed, for night duty only, at the civil disbursing office, guarding public funds and property.

Two watchmen are employed, for night duty only, guarding government property at the quartermaster's warehouse.

Two watchmen are employed, for night duty only, at the customs property warehouse guarding government property.

Other watchmen are employed only when circumstances render such employment absolutely necessary.

Total expenditures, vouchers paid, $1,092.50

III. Office expenses of the district commander: The employees of this office are as follows: Alcides Betancourt, secretary to the commanding officer, salary, $150 per month; Sarah Carbiras, typewriter, salary, $40 per month; José Castillo, clerk, salary, $30 per month; Henry Betancourt, messenger, salary, $30 per month; José Antonio Areu, janitor, salary, $30 per month; Francisco Arteaga, laborer, salary, $3 per month.

Expenditures for six months ending December 31:	
Vouchers paid	$1,991.52
Liabilities	19.04
Total	2,010.56

Digitized by Google

IV. Office expenses of the disbursing officer and quartermaster, this city: 1. The employees connected with the quartermaster's office are J. Z. Bazan, clerk in charge of receiving and shipping supplies, salary, $100 per month; R. Z. Bazan, clerk, salary, $75 per month; total expenses connected with the quartermaster's department are $1,050.

2. The employees belonging to the civil disbursing office are: Ubaldo Socarrás, clerk cash department, salary, $100 per month; Philip H. O'Connor, clerk correspondence and property departments, salary, $100 per month; Antonio Iraola, clerk in charge of customs property and warehouse, salary, $100 per month; Cláudio Espinosa, storekeeper at customs property warehouse, salary, $50 per month; Antonio Torres, janitor, salary, $30 per month; José Docando, messenger, salary, $30 per month. There was purchased for this office one No. 6 Smith-Premier typewriter, and a photographing outfit complete.

The expenses connected with the civil disbursing office are:

Vouchers	$2,362.73
Liabilities	38.03
Total	2,400.76

Second Lieut. Hugh A. Roberts, Eighth Cavalry, was on duty as assistant in this office from July 1 until October 17, 1900.

I desire to call attention to the efficient and faithful work of Lieutenant Roberts and the employees of this office, and especially to the loyal support of all in the various classes of work that of necessity they have been called upon to perform.

Recapitulation.

Expenses connected with the quartermaster's department:	
Vouchers paid	$1,050.00
Liabilities	.....
Total	1,050.00
Expenses connected with the civil disbursing office:	
Vouchers paid	2,362.73
Liabilities	38.03
Total	2,400.76
Grand total	3,450.76

V. Repairs to the old powder magazine now used as quarters for a detachment of the rural guard: The repairs consisted in repairing the floors, windows, doors, and roof to the building. Total cost of expenditures for the six months ending December 31, 1900, was $158.

VI. Office expenses of the rural guard: Adolfo Verjano is employed as clerk at a salary of $75 per month. The following are also charged to this office: Rents of office and quarters for rural guard or detachments of same, lights, oil, stationery, expenses connected with enlistment, promotion, etc., of the rural guard, traveling expenses of members of the rural guard.

Expenditures:	
Vouchers paid	$647.33
Liabilities	102.21
Total	749.54

Report on expenditures of customs funds appropriation, military department, barracks and quarters, fiscal year 1901, for the period July 1 to December 31, 1900.

The following funds were received from the treasurer of the island:

July	$2,298.25
August	1,158.25
September	2,954.50
October	2,587.75
November	2,520.75
December	6,188.25
Total	17,707.75

The work undertaken and performed with expenditures were as follows:

I. Emergency expenses connected with United States troops: Under this heading the work was the following: Ditching to properly drain Camp Mackenzie; ditching to properly drain in the vicinity of the railroad siding and around the warehouses; repairing the two water tanks at Camp Mackenzie; loading and unloading supplies shipped on the railroad at Camp Mackenzie; loading and unloading supplies shipped

Digitized by Google

VIEW OF NUEVITAS.

Digitized by Google

Digitized by Google

on the railroad at Puerto Principe; building tent floor and making necessary camp arrangements; building railroad crossing, Camp Mackenzie; repairing roads in and near Camp Mackenzie; clearing off trees, brush, and rubbish in and around Camp Mackenzie; repairs to bathing facilities for enlisted men at Camp Mackenzie.

Total expenditures:	
Vouchers paid	$1,536.94
Liabilities	202.97
Total	1,744.91

II. Rents: The property rented on December 31 is the following: Building (first floor) used as offices for civil disbursing office and disbursing quartermaster, $30 per month; building used as warehouse for customs property, $75 per month; land used in connection with quartermaster's warehouse, this city, $12 per month; grounds used by united States troops as camping ground and pumping station.

For these grounds Mr. S. Moran makes claim to the property, but is unable to prove ownership. The rental claimed by Mr. Moran is $30 per month for both pieces of land. Efforts to establish ownership to this land by this office have been unsuccessful, and the matter is now taken up by the district commander.

Total rents paid for the period ending December 31	$604.62
Liabilities determined	142.00
Liabilities on account of claim pending	300.00
Total	1,046.62

III. Supplying water to United States troops at Camp Mackenzie: Water is obtained from the Guije Creek and pumped about 1 mile through 2-inch pipe to two tanks in camp.

The water pipes are above ground. The pumping apparatus consists of 1 new boiler, 20 horsepower; 1 small boiler pump, and 2 supply pumps. One of these pumps is a No. 3 Knowles pump, but is unserviceable, the other is a No. 3 Blake pump, which, though serviceable, is nearly worn-out. The entire pumping machinery is under cover.

Cost for six months ending December 31:	
Vouchers paid	$705.61
Liabilities	197.50
Total	903.11

IV. Military bridge over the Hotebonica: This bridge was required for traffic between this city and Camp Mackenzie. It is a frame bridge resting on masonry abutments, and is approximately 12 feet wide by 40 feet long. The material in the old bridge, which was built in December, 1898, was utilized as far as possible, and the present bridge is in good condition. Total cost, including abutments, $296.25.

V. Temporary forage warehouse, Camp Mackenzie: This warehouse is 26 by 200 feet, and was largely built from material on hand. The roof is boards with battens. The building cost $950.

VI. Temporary officers' mess building: This building was built for a general mess for officers. The main part is 36 by 48 feet, with walls 12 feet high. The roof is galvanized corrugated iron, and the building has an 8-foot porch on three sides. The addition is 18 by 24 feet, with galvanized corrugated iron roof, and is used as a kitchen. The kitchen was built from material on hand, excepting the roof. The cost of this building was $1,015.

VII. Temporary quartermasters' warehouse, Camp Mackenzie: This building is 26 by 200 feet and the walls 12 feet high. The building is divided into a clothing room, fitted up with shelving, a general warehouse room, a small storeroom, and an office room. The building is roofed with galvanized corrugated iron. Material on hand was used as much as possible. Total cost of this building was $1,225.

VIII. Temporary reading room and library for enlisted men at Camp Mackenzie: This building is 36 by 54 feet and walls 12 feet high. It has a galvanized-iron roof, and porches on three sides. The building was nearly completed December 31, and cost $1,778.12.

IX. Artesian-well boring: This expenditure covers the boring of a well on the site proposed for a military post. The well is 510 feet deep and 8 inches in diameter. The water is of excellent quality, and comes within 8 to 12 feet of the surface. The cost was $1,333.01.

X. Surveying party: This party was employed in connection with plans, map, etc., of the proposed post site near Puerto Principe. Total expenditures were $242.

XI. Temporary commissary warehouse at Camp Mackenzie: This building is 26 feet wide, 200 feet long, and wall 12 feet high. The building is divided into four rooms, the first for butcher shop and cold storage, the second for general storeroom,

Digitized by Google

sale, and issue room, the third for an office, and the fourth for the commissary sergeant. The building was about half completed December 31, 1900, and cost as follows:

Vouchers paid	$2,491.14
Liabilities	6.95
Total	2,498.09

Report for that part of the workings of this office which relates to the appropriation municipalities, sanitation, fiscal year 1901, for the period July 1 to December 31, 1900.

The following statement shows the amount of funds received:

From the treasurer of the island:	
July	$4,500
August	5,640
September	13,708
October	14,392
November	20,692
December	14,602
Total	73,534
From collections on account of privy cleaning:	
July	101
August	248
September	134
October	158
November	130
December	81
Total	852
Grand total	74,386

The expenditures have been considered under the various headings as given below, showing general character of the work undertaken, accomplished, and amounts expended.

I. Street grading and paving: Under instructions of the military governor, work of this class was begun September 3, 1900.

The general work was to grade Caridad street and streets crossing it, and also build a central walk and pave said street.

The working parties were under Mr. José Luaces, and the engineering work under Mr. J. E. Agramonte, civil engineer, until October 20, when Mr. Agramonte was placed in charge of the entire work. This street is one of the most important in the city, is 2,634.54 feet long, extending from Caridad Bridge to Caridad Plaza, and averages 60 feet in width. Before September, this street during rainy weather was almost impassable, and may be best described as a plain natural dirt road. The amount of excavations on Caridad street amounted to 69,500 cubic feet, and on cross streets to 83,200 cubic feet, making a total of 152,700 cubic feet. The fillings amounted to 76,350 cubic feet. The central walk is 10 feet wide, extending the entire length of the street. The retaining walls for the walk are stone masonry 18 inches thick, 2 feet deep, and having a total length of 4,640 feet. These retaining walls were all completed prior to December 31. By this time stone slabs were laid on one full block and part of another block, in all 1,700 square feet. The paving slabs are native milestone. The street is to be paved with crushed rock. and when completed is to have a thickness of 9 inches. The paving is being done in accordance with specifications for macadam road, as laid down in Gilmore's Manual.

On December 31, crushed rock was laid the entire length of Caridad street, and on both sides to a depth of 4 inches. To carry on the paving of this street one rock crusher, with steam engine complete with a liberal supply of spare parts, was purchased for $1,949.30, which includes duties and freight to Nuevitas, Cuba. One Buffalo Pitts 10-ton steam road roller was also purchased at a cost of $3,101, delivered at Nuevitas, Cuba, duties and freight prepaid. Before the receipt of the rock crusher, the breaking of rock was done by hand. Before the receipt of the steam road roller, the ordinary road rollers were used to the best advantage possible.

The total expenditures to December 31 are as follows	$26,080.88
The total liabilities not paid are as follows	5,807.89
Thus making the total cost to include December 31	31,888.77

II. Surveying party: The object of this work is to obtain a complete and accurate map of this city. At the present time no such map exists.

The work done by this party is as follows: 1, plan, elevation, and section of carcel,

Digitized by Google

this city; 2, map of that portion of this city which includes the old cavalry barracks, the quartermaster's warehouse, artesian-well plant, civil hospital, carcel, and railroad station; 3, map, plan, and section of Caridad street, showing old grades, etc; 4, map, plan, and section of Caridad street in accordance with proposed improvements; 5, map of the town of Las Minas, showing ditch built to prevent floods in the town; 6, map of the province of Puerto Principe, showing municipalities, compiled from most reliable data obtained; 7, copy of old map of the city of Puerto Principe; 8, leveling for sewerage and water pipes in general hospital, this city; 9, plan, section, and side view of Caridad Bridge; 10, plan and section of proposed repairs and alterations to Caridad Bridge; 11, plan, section, and side view of Casino Bridge; 12, plan, section, side view, and detail drawings of proposed new bridge (Casino Campestre); 13, profile drawing and plan of ground from proposed water source to water tanks, Camp Mackenzie; 14, copies of two maps showing grounds as claimed to be occupied by United States troops near this city; 15, map of 37 blocks of Puerto Principe; total expenditures were $1,235.97.

III. Drainage at Las Minas, Cuba: This town has always suffered from floods during the rainy season on account of the water from the mountains and slopes back of it. The natural course of this water was through the center of this city. It therefore became a necessity to change the water course, and the plan settled upon was to construct two large ditches, divide the water, and deviate it from the town. The ditch to the east was started in June and completed in July. The ditch is 2,950 feet long, 12 feet wide on top, 9 feet wide at the bottom, and averages 3 feet in depth. This office also constructed a ditch 2,600 feet long from the railroad station to Black River, besides ditching several of the important streets of the town. The total expenditures during the month of July were $907.45. The ditch to the west of the city was made by the public works department.

IV. Casino Bridge: The old bridge has for some time been beyond repair, and as the ayuntamiento of this city requested it, $1,300 was asked to build a new bridge. The proposed bridge is to be of timber, 32 feet wide and 53 feet long. The bridge is to be of three spans and to rest upon a foundation of piles. Only $10.50 was expended by December 31, 1900.

V. Sanitary inspector: Dr. J. A. Ponce was appointed sanitary inspector by General Orders, No. 22, Headquarters District Puerto Principe, Cuba, November 13, 1900, at a salary of $125 per month. His duties are not directed from this office, as his employment is in connection with the office of the district commander. Total amount paid Dr. Ponce to include December 31, 1900, $212.50.

VI. Artesian-well boring: Under this heading one well was begun, 75 feet from the first well on the public ground used by the quartermaster's department, this city, the other at the public market place, this city. The first was begun October 10, 1900, and completed December 15, 1900. It is an 8-inch well, 202 feet deep. Experience has shown that these wells need not be sunk deeper than about 200 feet to obtain an ample supply of good water. The second well was begun December 15, 1900, and on December 31 was 40 feet deep. This is to be an 8-inch well also. The first well is to be used in connection with the supply of water to public buildings, the general hospital and carcel being the buildings now using water from the apparatus now on the ground. The well at the market place is intended for the supply of good water to the general public. These wells are not flowing; the water raises to a point about 35 feet from the surface. If wells are driven too deep, the water becomes brackish and unsuitable for drinking purposes.

The cost of these wells up to December 31, 1900, is as follows:

Expenditures	$1,044.50
Liabilities	100.00
Total	1,144.50

VII. Street cleaning department: This department is under the charge of Mr. Alberto Agramonte. It has swept daily, Sunday excepted, about 50 miles of streets and alleys, and carted away approximately, 9,360 cubic meters of dirt and garbage. Besides doing this, the department has kept the streets and outskirts of the city, including 1½ miles of river banks, free from weeds and grass. It has also constructed about 3 miles of ditches and kept the same open to afford suitable drainage.

In addition the department has made all minor repairs to the streets in the city, and has used 1,200 cubic meters of materials in filling mud holes and bad places.

Mr. Agramonte has charge of the departments "collection of garbage" and "emptying and cleaning privy vaults," and it is my opinion that great credit is due these departments for the thorough work done, as is shown by health record of the city and the fact that not a single case of yellow fever has occurred in the city for over a year.

Digitized by Google

The money expended for the department of street cleaning is as follows:

Expenditures	$14,746.55
Liabilities	60.00
Total	14,806.55

The above includes the purchase of one pair of mules for $300 which is used by this department.

VIII. Collection of garbage: This work consists in the collection of garbage from house to house every night, excepting Saturday.

Approximately 7,500 cubic meters of refuse have been carted away since July 23, 1900, when this office assumed charge of this work. The expenditures have been $2,263.

IX. Emptying and cleaning privy vaults: Up to December 31, 1900, this department has emptied and cleaned the following privies:

1. Seventy-nine privies belonging to buildings occupied as public schools, the total capacity of which was 36,600 cubic feet and the fecal matter removed being 3,200 cubic feet of solid and 43,000 gallons of liquid matter. The largest privy vault of this class is that belonging to the San Francisco College, which has a capacity of 4,050 cubic feet.

2. Seventy-five privies belonging to private parties, who have paid for this service. The total capacity of these privies is 20,600 cubic feet, and there were removed therefrom 16,500 cubic feet of solid matter and 13,000 gallons of liquid matter. The largest privy of this class had a capacity of 1,200 cubic feet. For this work the government has collected $852.

On December 31, all of the above amount had been deposited with the treasurer of the island, excepting $81, which was deposited January 7, 1901.

3. Twenty-two privies belonging to public buildings. The total capacity of these is 26,300 cubic feet, and the fecal matter removed was 11,100 cubic feet of solid and 673,000 gallons of liquid. The largest privy of this class is that of the general hospital (civil), the capacity of which is 5,800 cubic feet, and out of which is pumped daily about 9,000 gallons of liquid matter. These privy vaults belonging to public buildings were entirely rebuilt by this department.

Expenditures:

Vouchers paid	$2,912.67
Liabilities	6.00
Total	2,918.67
Deposited with treasurer on account of collections	771.00

Report in connection with expenditures from customs funds municipalities, instruction, fiscal year 1901, for the period of July 1 to December 31, 1900.

This work consisted in setting up and repairing school furniture in this city, and $1,350 was received from the treasurer of the island for the purpose.

One hundred and twenty teachers' desks were received late in September, and were immediately set up by this office and turned over to the alcalde of the city.

There are 79 schools in this city, and when this office took charge of the work of setting up the furniture, it was found that the greater part was not set up, and that which was set up had not been put together properly, and hence had to done over again.

The work done was as follows:

Teachers' chairs set up	35
Scholars' desks set up	1,797
Scholars' desks taken apart and set up properly	1,229
Bookcases set up	35
Bookcases taken apart and set up properly	45
Scholars' desks rearranged on account of floor space and light	896
Teachers' chairs taken apart and set up properly	47
Ends to scholars' desks set in place	12
Ends to scholars' desks taken apart and set up properly	87
Scholars' desks set up at depot and placed in various schools	363
Ends to scholars' desks set up in depot and placed in various schools	188
Sets of shelving taken from back of district commander's office and set up at schools	2
Stepladders made for school purposes	3
Foot rests made for desks	5

The following were set up and left stored:

Ends for scholars' desks	437
Book cases	16
Teachers' chairs	10

Digitized by Google

The matter of setting up this school furniture was reported by this office on June 6, 1900. Two telegrams are here quoted explaining the difficulties:

HABANA, *June 5.*

SYMMONDS, *Puerto Principe:*

For the information and guidance of the alcaldes to whom school furniture has been shipped, you will please have one or two school desks set up complete, so as to show the construction and arrangement of the several parts constituting complete desk. If necessary, you are authorized to employ skilled workmen to superintend the setting up of the desks after delivery to the alcaldes.

HUMPHREY.

PUERTO PRINCIPE, *June 6, 1900.*

CHIEF QUARTERMASTER, DIVISION OF CUBA,
Habana, Cuba:

Consulted alcalde and secretary public instruction this city and hacienda reference yours 5th. About 180 have been set up and none care for assistance except to obtain authority for use of funds now in possession of secretary public instruction. About $8,000 was transferred by the hacienda to the secretary public instruction for installing the schools this municipality. Of this he has about $1,500 left, but says he has no authority to use this setting up desks and transporting same to different schools. The desks that have been set up was done from city funds. Unless instructions regarding this are given the desks will not be set up for many months.

SYMMONDS, *Quartermaster.*

The work of setting up this furniture was completed December 19, 1900, and the total cost was $528.03, thus leaving a balance of $821.97 from the amount allowed.

Report of expenditures of customs funds, state and government jails, fiscal year 1901, for the period July 1 to December 31, 1900.

The carcel, this city, had no arrangement for separate bathing facilities and water-closets for male and female prisoners; consequently instructions were received to submit an estimate for funds to make arrangements for the division of these prisoners, and suitable arrangements for separate bathing, etc. Nine hundred dollars was allowed for this.

One of the rooms used by the female prisoners was divided, and in each half 1 water-closet and 1 bath tub were installed. Water for this purpose was piped from the main passing just in front of the building, and sewer pipe was laid to conduct the sewage to the large vault in the rear part of the building. The iron lattice work under the corridor was changed, so as to give more space for the prisoners, and an additional lattice cell was made, so that different classes of female prisoners could be placed in separate cells, each provided with bath and water-closet facilities. Four shower baths were put in the rear part of the building for use of the male prisoners. The water used to supply this building comes from the artesian well near the quartermaster's warehouse. This work cost $898.32, leaving a balance of $1.68 unexpended.

Report on expenditures of customs funds, justice, public buildings, fiscal year 1901, for the period July 1 to December 31, 1900.

The military governor, on his inspection tour at this place, directed that the old artillery barracks be used as a court building, and that the building be gotten ready so the courts could all move into it.

The courts which have rooms in the building are as follows: The audiencia, the entire upper floor except two rooms in the wing; the court of the first instance, the two rooms above excepted; the municipal court, five rooms on the first floor; the correctional court, all the first floor not occupied by the municipal court excepting two rooms.

The repairs and alterations completed December 31, are as follows: Thorough policing and cleaning of the entire building; building three partitions, each 20 by 30 feet, each provided with doors. Closing four arch ways and providing same with doors; cutting four doorways and providing same with doors; building platforms for the audiencia, also correctional court; changing the old bathroom into two storerooms with ample shelving facilities; making three signs for the courts; minor repairs to plaster and woodwork.

Digitized by Google

For this work $887.50 was received from the treasurer on October 2, and $420 on October 23, making a total of $1,307.50.

Expenditures to include December 31:	
Vouchers paid	$801.90
Liabilities	185.78
Total cost to December 31	987.68

On December 31 the correctional court and the municipal court had moved into the building.

Report in connection with expenditures of customs funds appropriation, municipalities, hospitals, and charities, fiscal year 1901, for the period July 1 to December 31, 1900.

The receipts and expenditures are considered under headings as stated below:

I. Orphan Asylum: For this purpose there was received from the treasurer of the island $2,250 on July 24, 1900. At that time it was proposed to convert the old cavalry barracks, this city, into an orphan asylum. The ground inclosed within this building is all that belongs to the building, and as more ground would be required for the purpose of an asylum, it was proposed to purchase a tract immediately back of the building. Later changes have postponed the opening of an orphan asylum, and therefore the land has not been purchased.

II. San Juan de Dios Hospital: This hospital had deficiency accounts for the month of October, 1899, which amounted to $851.40. In accordance with instructions from the division commander, as directed in an indorsement from the district commander dated July 20, 1900, a special estimate for $851.40 was submitted, and that amount made available.

Total expenditures were $851.40.

III. Carmen Hospital: Certain deficiencies were found to exist at this institution as follows:

October, 1899	$304.31
November, 1899	138.89
December, 1899	290.79
January, 1900	288.64
Total	1,022.63

In accordance with instructions from the division commander, as directed by the district commander, under date of August 21, 1900, special estimate was submitted including this amount. This money was allowed and made available September 27, 1900.

Expenditures:	
Vouchers paid	$1,022.42
Deposited to the credit of the treasurer of the island	.21
Total	1,022.63

IV. San Juan de Nepomuceno Asylum: A deficiency of $296.79 having been reported for the month of October, 1899, the district commander on August 22, 1900, under authority of the division commander, directed that a special estimate be submitted to cover this deficiency. The actual amount of the deficiency was found to be $264.37, and consequently this amount was included in a special estimate, which was allowed, and the money made available September 27, 1900. The total expenditures were $264.37.

V. San Lazaro Hospital: The following deficiencies were reported by this institution on September 25, 1900, viz:

October, 1899	$434.00
November, 1899	141.36
December, 1899	157.47
January, 1900	157.78
Total	890.61

The division commander directed on October 12, 1900, that this amount be estimated for. This was done, and the estimate having been allowed, the funds were made available December 12, 1900.

The expenditures were as follows:	
Vouchers paid	$890.53
Deposited with the treasurer of the island	.08
Total	890.61

Digitized by Google

VI. The General Hospital, Puerto Principe: This work consisted in repairing and remodeling the old infantry barracks for use as a civil hospital, the equipment of the same with modern furniture, instruments, and supplies of various kinds. The expenditures connected with the running of the institution, and incidentals, etc., connected with the opening as well as installing a paupers' dispensary.

Total funds received:	
On July 24, 1900	$15,620.06
On September 4, 1900	7,021.37
On October 2, 1900	12,776.82
On October 23, 1900	11,296.00
Total	46,714.25
Expenditures:	
Vouchers paid	36,707.06
Liabilities	8,712.26
Total	44,419.32

The work of preparing this building for use as a hospital was carried on under three headings—repairing and remodeling, equipping, running and incidental expenses.

Repairing and remodeling.—This work is considered under subheads:

A. Water supply: The water mains from the new artesian well were laid prior to July 1. Three-inch mains were laid within the building, making a closed loop. These pipes were laid under ground and all fixtures are connected to the main by either three-quarters or one inch pipe. The artesian water is of excellent quality.

B. Sewerage system: The sewage is carried by 4 4-inch mains to the vault in rear of the building. The adoption of the 4 separate mains was due to natural division on account of the location of fixtures and also to provide arrangements should any get out of order. The vault in rear of the building was thoroughly cleaned, disinfected and cemented, and 3 ventilating shafts provided. A pipe with connections was placed so the pump to the excavators could be connected without opening the vault. The old privy seats about the vault were removed, and new concrete floor laid. The sewer pipe outside the building is 4-inch glazed tile, while all within the building is cast iron, leaded joints.

C. Plumbing fixtures: The plumbing fixtures are all of the latest pattern and selected with a view to serviceability.

The following fixtures have been set: 16 bath tubs, roll rim enameled cast iron; 18 sinks, roll rim enameled cast iron; 7 slop hoppers, porcelain; 16 water-closets, bowls enameled cast iron; 1 wash basin, enameled cast iron; 3 shower baths.

The fixtures are all trapped and ventilated. In connection with the plumbing and fixtures it might be said particular care was exercised, and up to the present time there has not been a single break, leak, or trouble of any kind.

D. Hot-water system: The hot-water main is 1½-inch pipe, and is laid from the pump entirely around the building back to the pump again, thus forming a complete circuit. The fixtures are connected to this main by smaller pipe. The water is heated by the exhaust steam from the engine to the laundry, by the condensed steam from the mangle and the drying room. The hot-water supply for the kitchen and adjoining pantries is provided for under "the kitchen plant."

E. The kitchen plant: The kitchen is provided with a double range, 6 by 12 feet, with 6 separate ovens and fire boxes. To each side of the range is set 1 large hot-water boiler, which supplies all the hot water required by the kitchen and pantries in this building. This arrangement provides hot water at all times in the hospital, as there are 3 separate hot-water systems, the two above and the one connected with the laundry. The range is supplied with boilers, pots, urns, etc., making the plant complete.

F. Disinfecting plant: The disinfecting plant, which was taken out when this building was used as a barracks, was again set up and thoroughly repaired.

G. Operating room: The board floor was taken up, ground filled in, and glazed tile floor set; glazed tiles were also set to a height of 8 feet all around the room. The walls above this were replastered and painted with enameled paint. A new ceiling was put in and painted with enameled paint; the old-style windows were removed and new glazed windows substituted. The passageway to the operating room was also tiled with glazed tiles.

H. Steam laundry: A new plant, consisting of steam boiler, engine, 2 washers, 1 centrifugal, 1 mangle, and 1 drying room, were purchased and set up. In addition, stationary tubs were set up and provision made for hand ironing.

I. Alterations and additions: This consisted of making new doorways, closing up doorways not required, making partitions, repairing floors, walks, and repairing the

Digitized by Google

roofs. Under this subhead the following are included: The building of a large refrigerator with passageway and 3 compartments; the fitting up of the dispensary with counters, shelving, etc.; the building of 2 padded cells, and fitting up 2 rooms for insane patients; the making of cupboards, medicine cabinets, wardrobes, etc.

Funds received:	
July 24, 1900, from the treasurer	$8,724.50
October 2, 1900, from the treasurer	5,886.82
	14,611.32
Total expenditures to December 31, 1900	13,572.10
	1,039.22
Liabilities, December 31, 1900	1,023.09

Equipping general hospital.—This work was one requiring technical knowledge and experience of those who had knowledge of hospitals and hospital work. In this Dr. J. M. Delgado, Mrs. L. W. Quintard, and Miss Mitchell gave valuable assistance. None of the equipment required could be procured in this city, and as it takes from two to four weeks to receive supplies from New York and vicinity, the difficulties in making selections, revising orders, and drawing up specifications were very trying. Again, when orders were placed it would require from two to four months' time before the receipt of the goods. The funds received for this purpose were as follows:

July 24, 1900, treasurer of the island	$6,026.75
September 4, 1900, treasurer of the island	6,108.25
October 2, 1900, treasurer of the island	6,000.00
October 23, 1900, treasurer of the island	6,000.00
	24,135.00
Expenditures to December 31	16,040.12
	8,094.88
Liabilities	7,456.02

Running and incidental expenses.—Under this heading is carried the staff and employees of the hospital and the running expenses, the expenses connected with the care and treatment of the insane sent away, the expenses connected with the paupers' dispensary, etc.

Funds received:	
July 24, 1900, from the treasurer	$868.81
September 4, 1900, from the treasurer	913.12
October 2, 1900, from the treasurer	890.00
October 23, 1900, from the treasurer	5,296.00
	7,967.93
Expenditures, to include December 31, 1900	7,094.84
	873.09
Liabilities	233.15

List of supplies transferred to the general hospital for the period ending December 31, 1900.

Ax, hand	number	1	Commodes, oak	number	4
Anklets, restraint	pairs	2	Colanders, heavy	do	6
Basins, dressing	number	2	Cups, coffee	do	6
Basins, pus	do	36	Desk, record	do	1
Back rests	do	12	Dishes, pudding	do	24
Baskets, clothes	do	6	Dressers, oak	do	20
Baskets, waste	do	6	Dry room	do	1
Beaters, wire	do	12	Dishes, soap	do	48
Bed, small	do	1	Engine, center crank	do	1
Bells	do	2	Extract No. 7	do	1
Blankets, assorted	do	304	Forks, assorted	dozen	24
Boilers, soup	do	2	Forks, meat	do	4
Boilers, water	do	3	Funnels	do	36
Bowls, assorted	do	4	Graters, assorted	do	12
Boxes, brush	do	4	Griddles, soapstone	do	2
Boxes, bread	do	12	Hammers, carpenters'	do	1
Boxes, dredge	do	4	Hoes, assorted	do	2
Broilers, wire	do	6	Holders, soap	do	4
Buckets, enamel	do	4	Infusion apparatus	number	1
Cabinets, assorted	do	2	Inhaler, chloroform	do	1
Chairs	do	128	Inkstands	dozen	3
Chairs, folding	do	2	Irons, assorted	number	24
Chairs, rocking	do	48	Irrigators, Peerless	do	12
Chairs, revolving	do	2	Kettle, croup	do	1
Chambers	do	28	Kettles, tea	do	24
Chiffoniers, oak	do	5	Kettles, fish	do	6
Chisel, cold	do	1	Knives, assorted	do	27
Chopper, meat	do	1	Knives, chopping	do	4
Clocks, alarm	do	2	Knife with scabbard	do	1
Cleaver, butchers'	do	1	Knives and forks, assorted	do	24
Closets, china	do	9	Ladles, assorted	do	12

Digitized by Google

List of supplies transferred to the general hospital for the period ending Dec. 31, 1900—C't'd.

Lamps, alcohol	number..	12
Machine, pill	do....	1
Machines, sewing	do....	2
Mangle	do....	1
Mashers, potato	do....	2
Measures, tin	do....	8
Mill, coffee	do....	1
Mitts, canvas	do....	2
Mitts, leather	do....	2
Mugs, assorted	do....	96
Mattresses	do....	224
Nippers, carpenters'	do....	1
Pails, assorted	do....	42
Pails, milk	do....	12
Pans, douche	do....	24
Pans, dish	do....	18
Pans, dripping	do....	24
Pans, milk	do....	12
Pans, frying	do....	12
Pans, bed	do....	12
Picks, ice	do....	12
Pillows	do....	150
Pitchers, enamel	do....	4
Pitchers, assorted	do....	34
Pins, rolling	do....	6
Pitchers and bowls	do....	30
Plates, pie	do....	48
Pots, iron glazed	do....	6
Quilts	do....	10
Rake	do....	1
Range, kitchen	do....	1
Refrigerators	do....	3
Regenerator, formaldehyde	do....	1
Roaster, coffee	do....	1
Rulers	do....	6
Saucepans and covers	do....	40
Saw, butchers'	do....	1
Saw, hand	do....	1
Scrapers, wall	do....	4
Screens, bed	do....	32
Scale, platform	do....	2
Shakers, pepper	do....	102
Shakers, salt	do....	100
Skimmers, wire	do....	4
Skimmers, flat	do....	6
Skewers, meat	do....	2
Sieves, wire	do....	3
Shovels	do....	3
Spoons, asstd	do....	63
Sifters, flour	do....	2
Stands, asstd	do....	8
Stands, wash, with basins	do....	2
Stand, wash, comb	do....	1
Steels	do....	36
Sterilizer, comp. formdg	do....	1
Sterilizer, ward	do....	1
Straps, waist	do....	4
Stools, asstd	do....	4
Stretcher wheel	do....	1
Stove, 2 tier	do....	1
Stove, oil	do....	3
Sticks, candle	do....	12
Strainers, heavy	do....	2
Syringes, aseptic	do....	2
Tables, asstd	do....	54
Tables, oak	do....	30
Tank soap	do....	1
Trays, enamel	do....	24
Trowels, masons'	do....	2
Trucks, wash room	do....	2
Tubs, foot	do....	18
Tub, stationary	do....	1
Turners, cake	do....	6
Typewriter	do....	1
Urn, coffee	do....	1
Urinal, large	do....	1
Wardrobes, single	do....	24
Washers	do....	2
Washboards	do....	24
Wheelbarrows	do....	3
wringers, clothes	do....	2
Wristlets, restraint	do....	2
Washstands	do....	5
Backs, water	do....	8
Bacon	pounds..	50
Bag, canvas	number..	1
Baking powder	cases..	2
Bands, rubber	boxes..	6
Beans	pounds..	350
Egg beater	number..	1
Beef	pounds..	314
Bedside notes	number..	5,000
Blankets, white	yards..	31
Blue	pounds..	4
Boilers, water, attch. range	number..	2
Books, index	do....	4
Books, memo., asstd	do....	41
Books, record	do....	14
Book, register	do....	1
Boats, gravy	do....	6
Braid	packages..	156
Bread	ounces..	4,122
Bread	pounds..	275
Binders, large	number..	6
Bowls, China, asstd	dozen..	17
Brooms	number..	42
Brooms, corn	do....	48
Brooms, hair	do....	24
Brushes, hand	do....	7
Brushes, nail	dozen..	6
Bottles, oil and vinegar	number..	18
Book, prescription	do....	1
Buttons	gross..	4
Bowls, chopping	number..	4
Books, copy	do....	12
Books, time	do....	15
Canisters, hinged	do....	12
Canvas, white	yards..	10½
Charts, temperature	number..	1,000
Chocolate	pounds..	24
Cambric, cotton	yards..	320
Cloth, cotton	do....	1,645½
Cloth, cotton, unbleached	do....	372
Cloth, oil	do....	18
Cloth, table	do....	75
Cloth, stripped	do....	520
Clothesline	feet..	1,200
Clothespins	gross..	6
Clips, Niagara	number..	300
Coffee	pounds..	428
Combs	number..	30
Corkscrews	do....	24
Cotton waste	do....	100
Crinoline	yards..	406
Cups, egg	dozen..	18
Cups and saucers	do....	40
Demijohn	number..	1
Dishes, vegetable	do....	43
Dishes, glass	do....	12
Duck	yards..	21
Dusters, feather	number..	25
Eggs	dozen..	107½
Envelopes, asstd	number..	3,550
Envelopes, official	do....	800
Erasers, rubber	do....	12
Fasteners, paper	boxes..	6
Faucets attach. to range	number..	2
Faucet, wooden	do....	1
Flannel, white	yards..	324½
Fittings and connects	set..	1
Flour	pounds..	228
Flues	set..	1
Glasses, looking, framed	number..	2
Grates	do....	12
Half moons	pairs..	6
Ham	pounds..	250
History sheets	number..	4,000
Ice	pounds..	2,286
Ink, China	bottles..	1
Ink, black	do....	7
Ink, red	do....	12
Crash, unbleached	yards..	32
Irrigators, glass	number..	2
Jar	do....	1
Lard	pounds..	202½
Lard	cans..	17
Lime chl	do....	10
Linen	yards..	1,250
Linen toweling	do....	200
Linings, range	set..	12
Macaroni	boxes..	3
Matches	gross..	1
Meat	pounds..	326
Melons	number..	96

Digitized by Google

List of supplies transferred to the general hospital for the period ending Dec. 31, 1900—C't'd.

Milk	liters..	325
Mucilage	bottles..	6
Muslin	yards..	360
Napkins, table	dozen..	4
Needles	packages..	2
Netting, mosquito	yards..	122
Oil	pounds..	10
Oil, cylinder	gallons..	20
Olives	can..	1
Pads, scratch, asstd	number..	150
Pads, stamp	do....	2
Panels, oven	do....	6
Paper, letter	reams..	4
Paper, blotting	sheets..	24
Paper, sand	do....	6
Paper, toilet	packages..	50
Paper, T. W	reams..	8
Pencils, lead	dozen..	6
Pencils, slate	number..	12
Pens	gross..	1
Pens	boxes..	2
Penholders	number..	12
Petroleum, refined	cans..	49
Pepper, grain	pounds..	10
Mops, asstd	number..	72
Pineapples	do....	79
Pins	cones..	24
Pins	packages..	24
Pitchers, china	dozen..	8
Pipe and dampers	feet..	25
Plates, soup	dozen..	8
Platters, china	do....	2
Plates, china	do....	120
Pork	pounds..	110
Potatoes	do....	725
Pots, mustard	number..	12
Raisins	box..	1
Ribbon, cotton	packages..	75
Rice	pounds..	452
Rings and covers with, range	set..	12
Rope	feet..	150
Salt	pounds..	10
Saucers, china	dozen..	40
Sheeting	yards..	1,805
Shelf, double plate	number..	1
Slates	do....	12
Slippers, cloth	pairs..	108
Soap	barrels..	5
Soap	pounds..	20
Soap	cake..	1
Stamps	number..	49
Staples	do....	25
Starch, corn	barrel..	1
Starch, corn	pounds..	40
Sugar, asstd	do....	636
Thread	dozen..	9
Tomatoes	cases..	2
Towels	number..	50
Trays, glass	do....	4
Tray, soap	do....	1
Tumblers, glass	dozen..	40
Tureens, soup	number..	12
Twine	balls..	6
Vegetables	pounds..	864
Vermicelli	do....	12½
Vinegar	gallons..	38
Wax, Japan	pounds..	15
Wine	barrel..	1
Wood	cords..	16½
Acid, oxalic	pounds..	25
Adrian anesth	bottles..	20
Aguardiente	gallons..	40
Acid, citric	pounds..	2
Arnica tinct	do....	2
Adhesive plaster	roll..	1
Alum calcined	pounds..	2
Aristol	ounces..	2
Arnica flowers	pounds..	6
Arnica root	do....	6
Arseniate of soda	ounces..	2
Acid, boric, pwd	liters..	12
Acid, chromic	ounces..	2
Acid, lactic	liters..	3
Acetanilid	bottles..	6
Acid boricum pulv	do....	4
Acid gallicum	do....	2
Acid lacticum	do....	1
Acid salicylic	bottles..	4
Ammon. bromide	do....	2
Antimonii potass	do....	1
Argenti nitras cryst	do....	1
Argenti nitras fusum	do....	1
Acid, carbolic, crude	do....	24
Acid, aceticum	do....	4
Acid, tartaric	do....	4
Aetheris spiritus comp	do....	2
Alcohol	do....	20
Alum, lump	do....	4
Ammonia aqua	do....	8
Ammonia carbonas	do....	5
Acacia pulv	do....	2
Acid arsenosum	do....	4
Acid citricum	do....	2
Acid tannic	do....	2
Aloin pilulae comp	do....	3
Ammonia chloride	do....	5
Ammonia chloridum	do....	6
Amyl nitras	do....	4
Antipyrinum		12
Apomorphinæ hydro	tubes..	4
Aspidie oleoresina	bottles..	2
Atropiniæ sulphas	tubes..	2
Antiseptic tabs	bottles..	6
Acid carbolicum	do....	2
Acid hydrochlor	do....	2
Acid sulphuric	do....	2
Absorbent dyspeptic tabl	do....	1
Acetanilid tabl	do....	2
Acetanilid comp. tabl	do....	1
Acid arsen., iron, and strych. pills	do....	4
Acid gallic and ergot comp. pills	do....	1
Alkaline antisep-imp. pills	do....	2
Aloin, bellad., and podoph. pills	do....	2
Analgine	do....	1
Anodyne for infants	do....	1
Acacia	do....	2
Anticonstipation	do....	2
Acid, sulphuric arom	pounds..	2
Acid, carbolic	do....	25
Acid, acetic	do....	4
Acid, sulphuric	do....	10
Ammonia liq	do....	10
Acid hydrochl	do....	6
Acid, nitric	do..	2
Acid, sulph., pure	do..	2
Hamamelis ext	bottle..	1
Acid, citric	tin..	1
Alcohol	gallons..	10
Aconite root, fl. extr	bottle..	1
Aloes, fid. ext	do....	1
Angelica, fid. ext	do....	1
Arnica, fl. ext	do....	1
Asafetida, fl. ext	do....	1
Acid, boric	tins..	2
Acid, salicylic	tin..	1
Acid, phosphoric	do....	1
Acid, tartaric	tins..	10
Alum crystal	pounds..	25
Ammonia, arom	do....	2
Aloe pulvis	bottles..	4
Aether	tins..	20
Atropinæ, sulph	box..	1
Asafetida, tr	bottles..	1
Acid sulph., arom	do....	6
Aether spirits	do....	2
Ammonia, arom	do....	4
Acid phosph	do....	2
Aconite, tinct	do....	4
Aphrodisiac No. 1	do....	1
Astringent wash	do....	1
Antiseptic No. 6	do....	1
Ammonia, arom. spts	pints..	2
Aloin comp. pref	bottles..	2
Ammonia, U. S. P	pints..	2
Acid carb. and lini co	pounds..	5
Antitoxin concentrated	tubes..	10
Antitoxin standard	do....	10
Bismuth salicilate	pound..	½
Bismuth sublimate	do....	½
Bottles, empty	number..	48
Boxes, pill	do....	72
Bicarbonate of soda	pound..	1
Barbados tar	gallon..	1
Belladonna ext. fl	pounds..	2

Digitized by Google

List of supplies transferred to the general hospital for the period ending Dec. 31, 1900—C't'

Balsam copaiba	caps.	500
Bromide of camphor	ounces.	6
Bottles, asstd	number.	252
Bottles, empty	do	36
Bismuth, subnitrate	bottles.	4
Beef extract	jars.	50
Boxes, pwd. asst	dozen.	50
Borers, cork	set.	1
Brushes, shaving	dozen.	1
Bismuth subgallate	bottles.	2
Bottles, drop	number.	6
Belladonna tincture	bottles.	2
Bism. beta. nap. comp	do	1
Bism. subnit. and ipecac	do	4
Blauds mass	do	1
Blauds tonic lax	do	1
Bronchitis No. 4	do	6
Brown's mix. comp	do	6
Bromide stipple, vag	do	1
Boxes, antiseptic	dozen.	1
Boxes blanding vapor	do	1
Blandine, plain	pint.	1
Blandine, comp	do	1
Blandine, carbolized	do	1
Blandine, eucalyptolized	do	1
Blandine, mentholized	do	1
Blandine, thymolized	do	1
Blandine, camphorated	do	1
Boxes, oint	gross.	10
Boxes, pill	packages.	100
Boxes, powder	gross.	5
Boxes, twine	number.	2
Balsam tolu	can.	1
Belladonna leaves, fl. extr	bottles.	1
Benzoin comp., fl. ext	do	1
Bryonia, fld. ext	do	1
Buchu, fluid ext	do	1
Bellad. emplast	tins.	2
Boxes glass needles	number.	5
Bottles brandy	bottles.	48
Backs, glass	number.	6
Bellad. talcorum	bottles.	1
Buchu, ext., fl	do	2
Baskets sponge	number.	4
Cinchona ext	ounces.	6
Ceylon cinnamon	pound.	1
Ceylon cinnamon, powd	do	1
Cod liver oil	capsules.	100
Convallaria ext. fld	pound.	1
Chloride of iron liq	liter.	1
Coal, mineral	pounds.	6
Charcoal	do	2
Cocoa butter	do	3
Cotton	ounces.	4
Castor tinct	pound.	1
Creosote haya (beech)	do	1
Cera flora	cake.	1
Cem. oxalic	bottles.	4
Chrysarobin	do	2
Cuprii sulph	do	2
Copaiba, bals	do	3
Creta preparata	do	2
Cannabis indica, tinct	do	1
Chloral	do	10
Cocaine hydrochl. hyp	tubes.	2
Cosmine bromhydras	do	1
Copaiba pilulæ co	bottles.	5
Creosotum	do	1
Cuprii arsenio tabs	do	1
Chamois skins	number.	24
Calomel sacch	bottles.	2
Calomel, ipecac, and soda b. c	do	2
Camphor monobrom	bottle.	1
Cardiac dilatation	do	1
Carminative No 2	do	1
Cathartic, active	do	4
Chlorodyne	do	1
Creosote comp	do	1
Cystitis No. 1	do	1
Choral hydrate comp	do	1
Coloring tablets	do	1
Curarine sulphate	tnbes.	5
Codeine phosphate	do	5
Camphor U. S. P. spts	pints.	2
Chloroform	do	1
Cutter, root	number.	1
Cork molds	do	6
Corks, asstd	gross.	
Caustic holders	number.	
Cantharides, fld. ext	bottles.	
Cascara sagrada, fld ext	do	
Cherry bark, fld. ext	do	
Catechu comp	do	
Cemicifuga	do	
Cinchona, red	do	
Cinchona comp	do	
Colchicum seed	do	
Cubebs	do	
Cod liver oil	gallons.	
Columbia	bottles.	
Calaber bean	do	
Capsicum fld. ext	do	
Cardamon, comp	do	
Calomel	do	
Camphor	pounds.	
Camphor	boxes.	
Cylinders, glass	number.	
Cantharides emplast	tins.	
Codeina	bottles.	
Caffeine citrate	do	
Capsicum tinct	do	
Chloroformum	do	
Chicorium tinct	do	
Cocainæ hydrochl	do	
Colchici ext., fl	bottles.	
Collodium	do	
Ceratum resinæ	jars.	
Chloroform	bottles.	
Coca fluid ext	pound.	
Cotton, absorbent	pounds.	
Cotton, electric	do	
Cord, extension	do	
Corks	number.	
Damiana fld. extr	bottles.	
Digitalis, fl. extr	do	
Digitalis, tinct	do	
Digitalinum	tubes.	
Dispensatory U. S.	number.	
Diarrhea No. 1	bottles.	
Diarrhea No. 2	do	
Digestive No. 2	do	
Digitalis	do	
Dirisectic imp	do	
Dobells alk. sol	do	
Dover's powders	do	
Damiana comp	do	
Essence of rosemary	liters.	
Essence of thyme	liters.	
Escamonea, pwd	do	
Eucalyptol	ounces.	
Eucalyptol	bottles.	
Ergotin	do	
Extractors, cork	number.	
Emmenagogue, pref	bottles.	
Expectorant No. 3	do	
Endormitritis	do	
Ether, nitrous, U. S. P	pints.	
Ergot	bottles.	
Ether inhaler	number.	
Emplast. feni	boxes.	
Ergot ext. fld	bottles.	
Flaxseed	pounds.	
Files, prescription	number.	
Funnels, steel	do	
Formaldehyde tabs	tubes.	
Ferri and quin. sol	bottles.	
Ferri and iod. syrupus	do	
Ferri pyrophos	do	
Ferri sulph. exsic	do	
Ferrum reductum	do	
Ferri and potassi tart	do	
Ferri and potassi comp	do	
Finger cots	number.	
Filtering paper	packages.	
Ferri chloride, U. S. P	bottles.	
Ferri chloride tinct	do	
Fever (Davis)	do	
Formaldehyde solution	pounds.	
Formaldehyde containes	number.	
Gentian ext	pounds.	
Glycero. phosph. of lime	liters.	
Gauze	packages.	
Gauze	pounds.	
Gauze	yards.	

Digitized by Google

List of supplies transferred to the general hospital for the period ending Dec. 31, 1900.—C't'd.

Gauze bandages	packages	100
Gauze boric	boxes	2
Glycerine	bottles	4
Glycyrrhizae ext. purum	do	2
Glycyrrhizae mist. co. tabs	do	4
Guaiacol carb	do	2
Gloves, rubber	pairs	4
Gelatine caps	boxes	50
Glue, liquid	cans	4
Glycyrrhizae	bottles	4
Gelsemium tinct	do	1
Gonorrhoea No. 2	do	1
Guayac comp	do	1
Gelsemium fid. extr	do	1
Ginger fluid extr	do	1
Glycyrrhiza fid. extr	do	1
Glycyrrhiza quin	do	1
Gentian tinct	do	2
Helonias fid	do	1
Hops	do	1
Hydrastis fid	do	1
Hyoscyamus fid. extr	do	1
Hemp, Indian, fluid extr	do	1
Hair pencis	do	4
Hyosciami ext	do	1
Hydrag nit. unguent	jar	1
Hamemelis fid. ext	bottles	1
Hydrastis ext. fid	do	1
Hydrarg. oleatum	do	1
Hydrarg. oxidum	do	3
Hydrarg. chlor. corros	do	4
Hydrarg. chlor	do	2
Hydrarg. cum. creta	do	2
Hydrarg. chlor. bicarb. tabs	do	10
Hydrarg. iod. flav	do	1
Hydrarg. massa	jars	4
Hydrarg. massa tabs	bottles	4
Hydrarg unguentum	do	4
Hyoscyami hypo. tabs	tubes	1
Hyoscyami pilulae co	bottles	1
Hypoph. and quinine comp	do	1
Hydrastine comp	do	1
Hypod. aconitine	tubes	10
Hypod. apomorphine	do	10
Hypod. atropine sulph	do	20
Hypod. cardiac No. 2	do	10
Hypod. cardiac No. 3	do	10
Hypod. cocaine hydrochl	do	20
Hypod. digitalin	do	20
Hyoscine hydrochl	do	5
Hypo. antiasthmatic	do	10
Hypo. caffeine sodium	do	10
Hypo. ergotin	tubes	20
Hypo. phisost-salicy	do	5
Hypo. pilocarpin hydro	do	10
Ipecac fid. extr	bottles	1
Ipecacuanhae pulv	do	2
Iron sulph	do	2
Insect powder	tins	12
Iodoform gauze	boxes	2
Ipecacuanhae ext	bottles	1
Ipecacuanhae pulv	do	4
Ichthyolum	do	2
Iodoform	do	6
Iodum	do	4
Ipecacuanhae and opii	bottles	2
Insinglass plaster	packages	5
Iron peptonate comp	bottles	1
Iron pyroph. quin	do	2
Iodide of iron	ounces	4
Iodine sublimate	do	4
Jalap pwd	pounds	2
Jalap fid	bottles	1
Jars ointment	dozen	6
Jars porcelain	number	24
Kola fid. ext	ounces	6
Krameria comp. fl. extr	bottles	1
Kava kava fid. ext	do	1
Krameria fid. ext	do	1
Kola fid. ext	pounds	2
Lanolin ointment	do	2
Lacto phosphate lime sol	do	1
Lactate of iron	do	1
Linden-tree flowers	do	4
Laurel cherry water	do	4
Labels, asstd	number	5,464
Lavender comp	bottles	1
Linum pulv	tins	4
Lime chloride	bottles	24
Lingibius ext	do	4
Lycopodium	do	4
Lithia carb	do	1
Linimentum rubefactious tabs	do	1
Lituces paper, asstd	sheets	100
Lime water	bottles	1
Lavender comp	pints	1
Lemon	do	1
Mineral kermes	pounds	1
Manna rolls	do	3
Mannit	do	2
Magnesium carb	pounds	2
Magnesia carb	papers	4
Mercury chlor	bottles	20
Menthol	do	2
Morph. sulph. H. I	tubes	12
Morph. sulph. tabs	bottles	10
Mould, suppository	number	1
Morphinae sulph	bottles	5
Merc. iod. red	do	2
Morphinae sulph	tubes	100
Marshmallow fid. ext	bottles	1
Mercury bichl	pounds	5
Magnesia sulph	tins	10
Myrrhae tinct	bottles	2
Nux vomica, tinct	do	1
Nux vomica pwd	ounces	2
Nitrate of potash, pure	liters	1
Nucis vomicae ext. fl	bottles	2
Nitroglycerine H. I	tubes	1
Naphthalin	boxes	6
Neuralgia preferred	bottles	1
Nitroglycerine comp	do	1
Nitroglycerine	tubes	10
Oil, almond	bottles	3
Oil, cod liver	do	3
Oil, olive	gallons	1
Orange flower water	liters	12
Opium tinguia	pounds	1
Opodeldoc soap	do	6
Oleum gossypusem	bottles	4
Oleum terebinth	do	4
Oleum ricini	do	16
Oleum caryophylus	do	1
Oleum gaultheria	do	1
Oleum menth. pip	do	1
Oleum morrhuol	do	6
Oleum santali	do	1
Tinglu	do	1
Opii pilulae	do	2
Opii tinct. camph	do	1
Opium pulv	do	1
Ointment boxes	dozen	100
Opium and camphor	bottles	1
Opium, ipecac and lead	do	1
Orange comp	pints	1
Oint. acid salicylic comp	pounds	5
Oint. blue, U. S. P	do	5
Oint. zinci oxide benz	do	5
Oint. zinci oxide comp	do	5
Opium conc. tinct	bottles	1
Opium camph. tinct	do	1
Orange bitters	do	1
Oil turpentine	gallons	1
Oleum theobrom	tins	1
Opium tinct	bottles	4
Opii tinct. camph	do	4
Peruvian bark ext	pounds	1
Pancreatine	pound	1
Paraffin	do	½
Peptona	do	1
Peptonate of iron	do	1
Pencils, hair	gross	2
Peppermint	bottle	1
Pilocarpus	do	1
Podophyllin	do	1
Paper, blue	ream	1
Paper, wrapping	reams	12
Plaster, adhesive	rolls	42
Plaster paris	tins	25
Physostig, sulph	box	1
Plaster, adhesive	spools	60
Pepsinum	bottles	4
Pilocarpi ext	do	1
Podophylli resina	do	1
Prunl virg., ext	do	1
Plasters, mustard	dozen	6

Digitized by Google

List of supplies transferred to the general hospital for the period ending Dec. 31, 1900.—C't'd.

Plaster, blister	dozen	1	Soda chlor	bottle	2
Plaster, belladi	gross	1	Saccharum lactis	do	2
Plaster, capsicum	do	1	Sinapsis emplast	tins	6
Petrolatum opiatum	tins	12	Silk shade	yards	2
Plumbi acetas	bottles	4	Scillæ, pwd	pound	½
Potass	do	1	Sodium, bromide	bottles	2
Potass. acetas	do	4	Sodium, phosphas	do	1
Potass. bicarb	do	4	Sodium, salicylas	do	4
Potass. bromidium	do	4	Sulphur in rolls	kilos	5
Potass. iodidum	do	3	Sodii, bicarb., pulv	bottles	4
Permanganas, potass	do	4	Salol tabs	do	6
Potass. and sodii tartas	do	5	Salophen	do	1
Petrolatum, liq	do	2	Santoninum tabs	do	6
Phenacetine	do	6	Sodii, bicarb	do	6
Physostigma, tabs	do	1	Sodii, bicarb., menth. pip	do	4
Physostigma, sulph	tube	1	Sodii hyposulphis	do	2
Pilulæ camph. and opii	bottles	5	Sodii salicylas, tabs	bottles	2
Pilulæ carminatir	do	6	Strychnine, sulph	do	2
Pilulæ cathartic, comp	do	10	Sulfonal, tabs	do	22
Potass. chloras	do	2	Sponges, small	strings	50
Pressers, cork	number	2	Silk, oiled	rolls	6
Percolators, glass	do	4	Shades, eye	dozen	1
Pencils, hair	dozen	12	Strops, razor	number	6
Pill boxes	do	100	Syringes, penis, glass	do	50
Potass. arsen., liq	bottles	6	Stem pessaries, rubber	do	10
Pepsin and capsicum, comp	do	1	Strophanthi, tinct	bottle	1
Potassium, arsenite	do	1	Saline infusion	do	1
Potassium, chlorate	do	1	Salol compound	do	1
Potass., permanganate	do	1	Santonin and calomel	do	1
Peppermint	pint	1	Saw palmetto, comp	do	1
Potassium, bicarb	bottle	1	Sedative modified	do	1
Quin. hydro. chlor., H. I	tubes	10	Soda and mint	do	2
Quininæ, sulphate	tin	1	Sodium, bicarb. and pareg. comp	do	1
Quininæ, sulphate	bottles	60	Stroph and nitrol, comp	do	1
Quassia	do	1	Strychnine, nitrate	tubes	20
Qunico bark	pounds	4	Strychnine, sulphate	do	20
Qunico bark, pwd	do	4	Strong solution	do	10
Rhatany ext	do	1	Saccharin	bottle	1
Rhubarb	do	½	Sodium bicarbonate	do	2
Rhubarb, arom	bottle	1	Sinapis Nigra, pulv	tin	1
Rhus, aromatic	do	1	Sulphurate potash	liters	2
Rhei ext., fid	do	2	Tubes, testing	number	12
Rhubarb	do	1	Tempurol	ounces	2
Rhamus, pulvis	do	2	Terebethium	bottle	1
Rhei, pulv	do	1	Thymol	do	1
Rheumatic, improved	do	1	Tolu balsam	tin	1
Salts, epsom	pounds	2	Thermometers, D. scale	number	2
Saffron, pure	liters	¼	Tents, laminaria	dozen	2
Sandal	capsules	500	Tonsilitis mulf., comp	bottles	2
Secale, pwd	pound	1	Tar, soluble	do	1
Salol	do	2	Tolu	do	2
Santonine, pwd	ounces	2	Taraxacum	do	1
Sulphate of soda	liters	12	Talcum	tins	15
Soda, caustic	cans	10	Tueresol	bottles	10
Squibb's ext	bottles	6	Uva ursi, fluid extract	do	1
Soda, washing	pounds	10	Urinary test paper	packages	6
Spoons, Horne	number	12	Vaseline, white	pounds	4
Sponges, asstd	string	1	Valerianate, quinine	ounces	6
Sanguinaria	bottle	1	Valerianate, ammonia	pound	½
Sarsaparilla	do	1	Vials, asstd	gross	22½
Saw palmetto berries	do	1	Valerian, fluid extract	bottles	3
Seneca	do	1	Veratrum viride	do	1
Senna	do	1	Veratum virides	do	2
Serpentaria	do	1	Viburnium, comp	do	1
Spigelia	do	1	Veratrum virid., tinct	do	1
Squill	do	1	Vaccinations	packages	12
Squill, comp	do	1	White oxide antim	pound	1
Stramon leaf	do	1	Wire splint netting	yards	50
Strophantus	do	1	Whisky	bottles	48
Sponges, asstd	pieces	144	Warburg's tincture	do	1
Stomach pump	number	1	Wintergreen	pint	1
Speculum	set	1	Wintergreen, fluid	bottle	1
Soap, castile	kilos	10	Xanthoxylum	box	1
Sugar, white	tins	2	Yerba Santa	bottles	1
Sponges, chlorof	number	6	Zinc oxidum	do	2
Scillæ syrupus	bottle	1	Zinc sulphas	do	1
Sulphur lotum	do	2			

In closing this report I desire to specially mention the constant and efficient work of Mrs. L. W. Quintard. She has demonstrated beyond a doubt her knowledge and thorough ability in this line of work, and to her is due the greatest praise for all that has been accomplished.

Very respectfully,

CHAS. J. SYMMONDS,
Captain, United States Cavalry, Disbursing Officer.

CHIEF ENGINEER, HEADQUARTERS DEPARTMENT OF CUBA,
Habana, Cuba.

Digitized by Google

APPENDIX B.

OFFICE DISTRICT ENGINEER,
MATANZAS, CUBA, *January 7, 1901.*

SIR: In accordance with instructions from your office dated December 25, 1900, I have the honor to report as follows as to the operations of this office from June 30 to December 31, 1900:

CITY OF MATANZAS.

Street cleaning.

All the streets of the city, 709,690 square yards, have been swept daily and all the sweepings and house garbage, averaging 249 cart loads daily, have been removed. The street sweepings have been hauled to dumps, where fires have been kept constantly burning for destruction of all combustible matter. The house garbage and cesspool matter have been carried to sea in a self-dumping barge, provided with iron tanks for fluid matter and garbage holders for other house refuse, and dumped outside of this harbor.

Cesspools.

One hundred and seventy-seven cesspools have been cleaned, from which 8,760 barrels of solid matter and 182¾ odorless cart loads of fluid matter were removed.

Portable-can system.

Four hundred and eight houses, situated in the low-lying portions of the city where proper cesspools can not be made, are supplied with portable cans with lids and seats. Lime is also furnished, as a deodorizer and disinfectant. These houses are visited daily by carts employed exclusively for this purpose, which remove the full cans and replace them by clean ones. The full cans are taken to the barge, emptied, washed, disinfected, and returned to the houses. The average number of these cans emptied daily has been 470.

Financial statement.

Received from the treasurer, island of Cuba, since June 30, 1900		$35,716.56
Expended in street cleaning and sanitation		31,074.61
Balance		4,641.97
Specific purchases not yet made	$1,828.41	
Outstanding liabilities	2,319.94	
		4,148.35
		493.62

Sea wall.

Nine hundred and thirteen feet of sea wall, extending up the north bank of the San Juan River from its mouth, has been constructed. Behind this wall 1,796 cubic yards of fill has been dumped.

Financial statement.

Received from the treasurer, island of Cuba, since June 30, 1900	$3,659.75
Expended on sea wall	2,663.59
Available cash balance	996.16

Streets repaired.

There have been 30,459.66 square yards of street remetalled with macadam, 7,116.74 square yards of stone gutters (rubble) have been laid, 203.80 cubic yards of retaining wall have been built, 442.63 square yards of curbing have been built, and 401.44 square yards of street repaired.

Financial statement.

Received from treasurer, island of Cuba, since June 30, 1900		$21,550.00
Expended for repair of streets		18,812.09
Balance		2,737.91
Outstanding liabilities	$1,518.10	
Allotted for specific purchases not yet made	700.66	
		2,218.76
Available cash balance		519.15

Digitized by Google

CITY OF MATANZAS.

Digitized by Google

Digitized by Google

THE PASEO, MATANZAS.

Digitized by Google

Digitized by Google

VERSAILLES. MATANZAS.

Digitized by Google

Digitized by Google

BLOCKHOUSE, NEAR MATANZAS.

Digitized by Google

Digitized by Google

FORT SAN SEVERINO, MATANZAS.

Digitized by Google

Digitized by Google

YUMURI RIVER, MATANZAS.

Digitized by Google

Digitized by Google

UPPER SAN JUAN RIVER.

Digitized by Google

Digitized by Google

Building a garbage holder, barge City of Matanzas, and dump alterations.

There were constructed in July, under the department commander's orders, two compartments or garbage holders above the deck of the garbage scow, for the purpose of facilitating the work and doing away with the necessity of renting another scow for removing house garbage.

The dump or suitable wharf arrangement where this barge receives its cargo was also moved from the San Luis bridge down near the mouth of the river, and reconstructed to meet the necessary demands occasioned by the additional improvements to the barge. These alterations have not only greatly facilitated the working of this department, but have to a considerable extent reduced the expense in this particular portion of the work.

Financial statement.

Received from treasurer, island of Cuba, on August estimate	$750.00
Disbursements (services and supplies)	488.71
Used for sanitation	261.29
	750.00

Repair of garbage scow.

This barge was hauled out, the old zinc sheathing was removed, the bottom and sides recalked, tarred, painted, and coppered, and the boat otherwise generally overhauled and placed in a first-class condition.

Financial statement.

Received from treasurer, island of Cuba, on December estimate	$1,000.00
Disbursements (services and supplies)	941.04
Available cash balance	58.96

OTHER DISBURSEMENTS.

Public works (Matanzas Harbor survey):	
Amount allotted, June 30 to December 31, 1900	300.00
Amount disbursed	300.00
Municipalties (hospitals and charities):	
Received by transfer	2,498 95
Amount disbursed	1,632 02
Balance, deposited to the credit of the treasurer	866.93
Municipalties (sanitation, water-supply system, Bolondron):	
Received from treasurer, island of Cuba	662.61
Amount disbursed	634.22
Deposited to the credit of the treasurer	28.39
Military department (administration and rural guard):	
Received from treasurer, island of Cuba	535.72
Disbursed in accordance with letter, headquarters division of Cuba, dated October 17, 1900	535.72
Received from treasurer, island of Cuba, on December estimate	31.50
Disbursed to refund municipality of Remedios, as per eighth indorsement, division of Cuba, dated October 24, 1900	31.50

Very respectfully,

JOHN S. WINN,
First Lieutenant and Squadron Adjutant Second Calvary,
Disbursing and District Engineer Officer.

The CHIEF ENGINEER, DEPARTMENT OF CUBA,
Habana, Cuba.

Digitized by Google

APPENDIX C.

OFFICE OF DISBURSING OFFICER,
CIENFUEGOS, CUBA, *January 8, 1901.*

SIR: In compliance with your letter dated December 26, 1900, I have the honor to submit the following semiannual report of operations for the period ending December 31, 1900, at Cienfuegos, Cuba:

Borings in the bay of Cienfuegos:		
Labor	$36.88	
Material	32.69	
Service of lighters	175.00	
		$244.57
Sanitation, city of Cienfuegos, Cuba:		
Office—		
Salaries of engineer in charge, clerk and sanitary inspector	1,960.00	
Rent of office	71.00	
Rent of office furniture	8.40	
Rent of electric lights	17.39	
Stationery	38.10	
		2,094.89
Street repairing—		
Labor	2,039.00	
Hired carts	1,029.00	
Purchase, blue sandstone	18,964.30	
Purchase, white limestone	2,198.90	
Advertising for bids for stone	8.65	
Repairing tools	168.54	
		24,408.39
Stone crusher—		
Labor	2,102.22	
Hired carts	660.00	
Coal	532.00	
Material	131.30	
		3,425.52
Steam roller—		
Labor	718.53	
Hired carts	209.00	
Coal	80.00	
Material	62.18	
		1,069.71
Street guttering—		
Labor	712.62	
Hired carts	73.50	
Material	481.10	
		1,267.22
Street cleaning—		
Labor	6,119.15	
Hired carts	921.00	
Removing garbage	2,367.99	
Material	53.20	
		9,461.34
Stable department—		
Labor	2,048.61	
Forage for animals	1,231.56	
Medicine for animals	40.52	
Blacksmithing, etc	171.91	
		3,492.60
Disinfectants, purchase of lime		267.30
Improving water system—		
Labor	1,218.41	
Coal	120.00	
Purchase of 6-inch pipe	311.08	
Purchase of tools	87.25	
Repairing tools	167.85	
Material	83.06	
		1,967.65
Laying 2-inch water pipe from reservoir to Civil Hospital and to Orphan Asylum—		
Pipe and fittings	1,133.78	
Installing same	400.00	
		1,533.78
Total		49,252.97

This is divided as follows:

20 borings in bay of Cienfuegos, Cuba	$244.57
29,258 square yards macadam built	23,995.55
1,858 square yards street gutters built	2,139.72
194 feet pipe laid, street crossings	194.10
333 square yards sidewalk built	399.60
4,985 square yards miscellaneous streets graded and repaired with crushed stone	2,648.75
3,000 square yards streets paved	1,936.00
480,000 square yards streets swept daily	9,983.68
7,250 loads garbage hauled	3,180.25
102 cesspools cleaned	612.00
956 houses inspected	180.00

Digitized by Google

ENTRANCE TO HARBOR OF CIENFUEGOS.

Digitized by Google

Digitized by Google

PARK, CIENFUEGOS.

Digitized by Google

Digitized by Google

EARTHWORKS AT PASO CABELLO, CIENFUEGOS.

Digitized by Google

Digitized by Google

TRINIDAD.

Digitized by Google

Digitized by Google

PARK, TRINIDAD.

Digitized by Google

Digitized by Google

VIEW IN TRINIDAD.

Digitized by Google

Digitized by Google

VIEW NEAR TRINIDAD.

Digitized by Google

Digitized by Google

VIEW IN SANCTI SPIRITUS.

Digitized by Google

Digitized by Google

SANCTI SPIRITUS.

Digitized by Google

Digitized by Google

368 sacks lime distributed	$267.20
78 feet artesian well drilled	1,549.58
621 feet artesian-well pipe drawn	438.12
8,906 feet 2-inch water pipe laid, from reservoir to civil hospital and to orphan asylum, Cienfuegos, Cuba	1,583.78
Total	49,252.97
Allotments:	
Borings in bay of Cienfuegos	245.00
Sanitation, Cienfuegos	49,726.20
	49,971.20
Expenditures:	
Borings in bay of Cienfuegos	244.57
Sanitation, Cienfuegos	49,008.40
Total	49,252.97
Balances:	
Borings in bay of Cienfuegos	.43
Sanitation, Cienfuegos	717.80
	49,971.20

Outstanding liabilities, none,

Respectfully submitted.

W. A. RAIBOURN,
First Lieutenant Tenth Infantry, Engineer Officer, District of Cienfuegos.

The CHIEF ENGINEER DEPARTMENT OF CUBA,
Habana, Cuba.

APPENDIX D.

REPORT OF OPERATIONS AT SANTA CLARA

[First indorsement.]

HEADQUARTERS, DEPARTMENT OF CUBA,
Habana, February 15, 1901.

Respectfully referred to Maj. W. M. Black, chief engineer, Department of Cuba, who will publish this in his report.

By direction of the military governor.

J. B. HICKEY,
Acting Adjutant-General.

[Extracts from reports showing work done and Cuban funds expended at Santa Clara, Cuba, by First Lieut. P. D. Lochridge, Second Cavalry.]

Funds received from the treasurer, island of Cuba:		
July 8, 1899	$9,729.33	
August 8, 1899	10,230.22	
August 8, 1899	441.30	
August 31, 1899	6,188.88	
September 11, 1899	49,096.00	
September 18, 1899	4,408.25	
October 3, 1899	7,887.73	
October 31, 1899	4,019.83	
November 28, 1899	30,000.00	
December 13, 1899	153.75	
December 18, 1899	9,074.10	
December 20, 1899	6,000.00	
December 20, 1899	4,000.00	
January 12, 1900	16,486.08	
February 15, 1900	12,123.14	
March 10, 1900	4,600.00	
March 17, 1900	5,986.21	
March 29, 1900	2,112.44	
Total deposits		$182,536.26
Funds received by transfer:		
From Maj. W. H. Miller, U. S. V.—		
April 22, 1899	830.00	
May 8, 1899	1,000.00	
May 12, 1899	2,753.54	
May 23, 1899	1,160.00	
From Capt. C. B. Hoppin, Second Cavalry—		
June 2, 1899	1,000.00	

Digitized by Google

Funds received by transfer—Continued.		
From N. Y. Stamper, customs collector—		
June 6, 1899	$1,920.50	
June 28, 1899	7,392.21	
June 28, 1899	4,957.00	
From Maj. W. H. Miller, U. S. V.—		
July 21, 1899	2,000.00	
December 15, 1899	1,500.00	
February 16, 1899	62.50	
March 9, 1900	260.25	
March 26, 1900	343.76	
From Maj. E. F. Ladd, treasurer—		
March 1, 1900	240.00	
Total received by transfers		$25,419.76
Received from E. P. Hamblin, cleaning premises		12.00
Received from Franco Castillo, cleaning vaults		85.25
Auditor's reconcilement, February 28, 1900		.08
Census refundments, overpaid vouchers		10.00
Total received		208,064.06
Funds transferred:		
Deposited to credit island treasurer—		
July 18, 1899	9,434.85	
April 14, 1900	40.34	
April 14, 1900	5.28	
Transferred to Maj. W. H. Miller, U. S. V.—		
March 27, 1900	117.86	
		9,598.28
Deposited to credit island treasurer, March 26, 1900		18,736.43
Total transferred		28,334.71
Funds expended:		
Street cleaning—		
Material	654.73	
Labor	10,223.00	
Vault cleaning—		
Disinfectants	922.83	
Material	1,496.22	
Labor	11,548.12	
Improving water system—		
Labor	911.97	
Material	361.30	
Constructing tool house—		
Material	45.11	
Labor	45.80	
Fords leading to city—		
Material	80.98	
Labor	292.17	
Repairing city streets—		
Material	3,239.26	
Stone crusher	3,830.72	
Labor	22,223.96	
Total municipalities, sanitation		55,875.17
Hospitals and charities—		
Repairing Civil Hospital—		
Material	1,374.59	
Labor	1,861.00	
Repairing San Lázaro Hospital—		
Material	1,844.97	
Labor	1,680.70	
San Felix Orphan Asylum—		
Material	128.92	
Labor	114.05	
Repairing Maria Cristina Hospital—		
Material	560.54	
Labor	829.85	
Total, hospitals and charities		8,394.62
Municipalities, miscellaneous—		
Construction operating ward city hospital—		
Material	111.52	
Labor	214.40	
Total, municipalities, miscellaneous		325.92
Barracks and quarters—		
Repairing civil hospital—		
Material	339.78	
Labor	408.00	
Repairing quartermaster's storehouse—		
Material	135.14	
Labor	86.00	
Constructing target range—		
Material	47.61	
Labor	20.40	
Installing ice machine—		
Material	1,015.01	
Labor	491.60	
Expense of shipment	255.89	

Digitized by Google

Funds expended—Continued.		
Barracks and quarters—Continued.		
Cost of ice machine	$4,000.00	
Water piping—		
Material	1,423.78	
Labor	602.80	
Constructing shed for quarantined horses—		
Material	68.80	
Labor	75.80	
Repairing cavalry barracks—		
Material	3,699.93	
Labor	2,865.78	
Repairing band quarters—		
Material	887.57	
Labor	2,113.25	
Repairing military hospital—		
Material	3,737.47	
Labor	2,701.53	
Repairing quartermaster's corral—		
Material	270.55	
Labor	524.30	
Constructing cavalry stables—		
Material	4,231.96	
Labor	2,292.40	
Constructing crematory—		
Material	154.00	
Labor	129.90	
Total, barracks and quarters		$82,574.15
Administration and rural guard—		
Rent of furniture, commanding officer and disbursing officer offices	32.05	
Stationery	117.82	
Pay of interpreter	750.00	
Pay of clerk	663.33	
Pay of clerks, vital statistics	1,382.14	
Office sanitary inspector, Province Santa Clara—		
Stationery	6.80	
Travel pay	253.17	
Pay	450.00	
Pay of clerk to	100.00	
Total, administration and rural guard		3,755.31
Public works—		
Construction San Gil road bridges—		
Material	1,023.36	
Labor	775.50	
Total, public works		1,798.86
Civil government—		
Pay of interpreter	187.50	
Pay of clerk and janitor, building of beneficencia	240.00	
Total, civil government		427.50
Miscellaneous—		
Stationery, commanding officer and disbursing officer offices	37.70	
Rent of furniture commanding officer and disbursing officer offices	8.20	
Purchase of safe	247.65	
Purchase of typewriter	95.80	
Total, miscellaneous		389.35
Cuban census.		
Office of director.		
Telegrams	3.58	
Transportation	21.83	
Total, office of director		25.41
Office of assistant director:		
Salary of assistant director	3,000.00	
Salary of chief clerk	833.30	
Salary of clerks	3,000.00	
Salary of Spanish stenographer	640.00	
Salary of interpreter	290.00	
Salary of messenger	324.66	
Salary of laborer	131.81	
Transportation of officials	916.65	
Transportation of freight	11.00	
Transportation of express	33.40	
Subsistence of officials	818.39	
Rent of office	128.00	
Telegrams	65.96	
Purchase of furniture	12.12	
Purchase of material	27.38	
Purchase of stationery	39.00	
Establishing office	8.20	
Lights	88.76	
Laundry	12.39	
Ice	63.17	
Total, office of assistant director		10,439.19

Digitized by Google

Office of supervisor:		
Salary of supervisor	$1,200.00	
Salary of secretary	386.66	
Salary of messenger	193.33	
Salary of interpreters	72.00	
Transportation of officials	136.98	
Transportation of freight	7.00	
Subsistence of officials	38.12	
Telegrams	148.02	
Purchase of furniture	8.98	
Purchase of stationery	55.30	
Purchase of material	20.48	
Lights	11.04	
Ice	15.00	
Total, office of supervisor		$2,292.81
Salary of enumerators	49,542.50	
Salary of special agents	584.00	
Salary of monitors (instructors)	2,270.00	
Transportation monitors (instructors)	287.79	
Transportation of special agents	54.40	
Transportation of enumerators (visiting keys)	258.36	
Subsistence of special agents	20.35	
Miscellaneous (purchase of furniture and payment of freight)	4,398.18	
Purchase of post-office money orders	54.88	
Purchase of stationery, office disbursing officer	118.45	
Purchase of New York exchange	22.25	
Total, Cuban census		57,611.16
Total, Census disbursements		70,368.57
Total received		208,063.35
Total expended		202,244.16
Balance		5,819.19

The cost of all work is shown in this statement. The civil hospital is used by the sick of this judicial district; the leper hospital receives patients from the whole province. The San Felix orphan asylum takes care of orphans of this city. All the barracks, troop mess-halls, and the military hospitals are used by the United States troops stationed here. The quartermaster's corral and stables are occupied by United States stock.

The civil hospital and the asylums are municipal property. The barracks, stables, and military hospital are island property. The bridges were built and fords repaired so that the roads leading to the city might be used during the rainy season. The improvements to city streets were for making them more serviceable and improving the sanitation of the city by proper drainage. The work on water system and piping was done to bore an artesian well, clean out public springs, and to pipe water into the barracks and hospital and other public buildings. Vaults were cleaned and disinfected, and in many cases sanitary cans substituted, in order to remove one of the greatest menaces to the health of the city.

The military hospital was a veritable pest place when the Second Cavalry came here. The building was fumigated, cleaned out, floors torn out, earth underneath removed, and all parts thoroughly soaked with bichloride of mercury. Its vaults were cleaned, disinfected, and sealed up. The roof was renovated, the floors were replaced with glazed tiles, the plastering renewed and kalsomined, all the wood work painted, necessary gutters and downs and pump were put in, and bathing facilities provided. To begin with, the building was not only useless, but dangerous; now it is an excellent hospital.

The improvements on all the other barracks and hospitals were just as necessary, and were very similar in character. In addition, the latter had to be increased in size to provide detached kitchen for the lepers, separate apartments for the violent insane, and a ward to provide for sick who had formerly been housed in unsanitary rented buildings near the hospital.

The quartermaster's corral was dangerous for man or beast, on account of glanders infection. This place was fumigated, the doors, troughs, floors, and plastering were removed, and the whole inside thoroughly washed with a solution (1 to 1,000) bichloride of mercury. Everything was then replaced new and whitewashed. Some of the falling walls were removed, the roofs repaired, and facilities for watering stock provided.

* * * * * * *

PUBLIC WORKS AT SANTA CLARA.

Three bridges on the San Gil road, over the Ajocenado, Minero, and Majagua creeks, between 2 and 3 miles north of the city. These bridges were estimated for and built together; their estimated cost in approved project for the work was $1,800.

Digitized by Google

The amount of money allotted for the work was $1,800, and the amount expended up to June 1, for material: $1,023.36; for labor, $775.50; total, $1,798.86.

The first mentioned, Ajocenado, is a single span bridge, 4 meters long, with guard rails. Each of the others is a trapezoidal truss, 7 meters long. Height of Ajocenado bridge, 1.3 meters; Minero, 1.8 meters; Majagua, 1.5 meters. The abutments are of stone and brick masonry, the bottoms of all being laid in cement. In all there are 130 cubic meters of masonry, costing $9.25 per cubic meter. The excavations for abutments, 80 cubic meters, costing 30 cents per meter.

Amount of lumber used in construction, 70.92 feet, which cost in Santa Clara, Cuba, $35 per thousand; cost of hauling to bridges, $6 per thousand; cost of lime, 32 cents per hundredweight; cost of hauling same, 15 cents per hundredweight. Cost of brick in Santa Clara, $11 per thousand; hauling same, $6 per thousand. Average cost of rock delivered at bridges, $2 per cubic meter; sand, $1.60 per cubic meter; cement in Santa Clara, $4.50 per barrel; hauling same, $1.50 per barrel. Cost of labor per day, $1; number of laborers employed, 34; Engineer Payrol in charge of work was paid $4 per day. Cost of making embankments for approaches 35 cents per cubic meter. Work on these bridges was done with sanitary tools belonging to the city.

* * * * * * *

In compliance with your direction of July 3, 1900, I have the honor to report the following engineering work in Santa Clara:

Constructing 5,904 yards of macadamized street, with a thickness of 10 inches of crushed limestone, costing 86½ cents per square yard. Grading 37,938 square yards of street, at an average cost of 35 cents per square yard. About half of this work was in soft rock, the excavations varying from a few inches to 6 feet in depth. Constructing one wooden truss bridge in Princesa street, Santa Clara, 121 feet long and 19 feet wide, with two piers of masonry, making three equal spans. Cost: Labor, $881.75; material, $1,257.08; total, $2,138.83.

* * * * * * *

The Belico and Cubanicay streams were cleaned out because they were so offensively foul that medical officers said the work must be done or the health of the city would be greatly endangered. The four washhouses were repaired, so as to keep these streams from being again ruined with all the washing of the city.

The Maria Cristina Hospital was repaired so as to provide the city with a much-needed place for contagious diseases. The disinfection was done to terminate an epidemic of yellow fever here.

* * * * * * *

The labor in street cleaning consists in sweeping the streets and hauling away the trash from 178,000 square yards of street area per day, amounting in all to about 35,824 cubic meters of garbage. The material consists of carts, brooms, etc., for carrying on this work. The material for vault cleaning was for repairing broken parts, and the labor is for cleaning about 270 vaults of 1,150 cubic yards of liquid and 5,825 barrels of solid material. The material for improving water system was for fuel and oil for well auger, and the labor was for cleaning out Chamberi spring and running the well auger.

Disinfection material is for purchase of lime, creolina, bichloride of mercury, sulphur, chloride of lime, charcoal, salt, alcohol, etc., and the labor is for applying same to stamp out yellow fever here.

Public washing house material consists of lumber, piping, tanks, brick, cement and similar material for renovating the four public washhouses of the city, and the labor is for cleaning out, repairing and painting the houses throughout, and constructing vaults for waste water, for supplying fresh water, and, building wash vats.

The labor for Cubanicay and Belico streams was to clean them and their banks, and to open up a passageway for the stagnant water and soapsuds therein.

* * * * * * *

[Extract from a paper read at the officers' lyceum, Santa Clara, Cuba, by J. M. Wheata, acting assistant surgeon, U. S. A.]

* * * * * * *

"The work was taken up systematically. Sanitary medical officers then began to make a painstaking inspection of each and every premises in the city, carefully mapping the same and designating each unsanitary feature of whatever nature by a system or code devised by the medical officer engaged in the work of inspection.

"It at once became a systematized and routine matter to conduct the work of removal. Six hundred and thirty-seven premises were designated as being in need of attention. These were graded according to the degree of insanitation and the premises of the first or worst grade were given the first attention. The yards con-

Digitized by Google

taining superficial filth were first cleaned, after which the residents were required under penalty to clean them daily, the resulting accumulations being hauled away each morning by wagons and then conveyed outside the city limits. This system is still maintained and proves satisfactory. In connection with this work the more important work of cleaning, removing, destroying or reconstructing sinks and vaults was vigorously pushed.

"An especial canvass of the city was made by medical inspectors with a view to locating and grading the vaults according to their need of attention. The number thus designated was 517.

"This branch of work has been conducted as follows: An odorless excavator pumps out the liquid portion of the contents, after which a crew of laborers removes the solid residue with shovels. Thus far 214 of the worst vaults have been put in a sanitary condition. The quantity of liquid matter removed from the vaults is 931 cubic yards, and of solid matter 4,800 barrels have been carted away. After a vault has been emptied it is thoroughly disinfected with quicklime under the direction of the sanitary medical officer. In cases where such officer deems it necessary he is furnished with as much as he desires of bichloride of mercury, chloride of lime, carbolic acid or creoline, considerable quantities of the latter being used by the laborers to deodorize and disinfect while in the vaults, all of this work except that done by the odorless excavator being done at night between the hours of 10 and 4 o'clock. Many vaults were found in ruinous condition, contaminating adjacent wells and cisterns. Such of these as were worthy of repair and use were cleaned and cemented, while many others which were merely uncovered holes were cleaned, disinfected, and filled, and individual sanitary commodes substituted. These cans are emptied by a special department every other night at a cost of $1 per can per month. Lime is supplied to the families using the cans to keep them disinfected constantly, and experience thus far seems to justify the method. Up to this time about 200 of these commodes are in use. During the year ending March 1, 1900, the number of cart loads of refuse removed from the city was 33,600. The sum of $31,966.41 has been expended for work which is exclusively sanitary improvement, while the expenditures for cleaning and repairing hospitals, asylums, jails, barracks, repairing streets, improving water systems, etc., furnishes a total of $56,705.09.

"That this work has been energetically carried forward, and that no grass has grown under the feet of the officials in charge, is evidenced by a comparison of results here and in Habana. The close of the year 1899 found 33 per cent of the work of vault cleaning completed in Santa Clara, as against 26 per cent in Habana, while of refuse removed more than two and a half times as much, measured according to population, had been carted from this city. One of the most important features of the great reform, and certainly fraught with most interest and concern to foreigners, has been the control or eradication of yellow fever and smallpox."

* * * * * * *

APPENDIX E.

HEADQUARTERS DEPARTMENT OF CUBA,
OFFICE OF ASSISTANT ENGINEER,
Quemados, January 29, 1901.

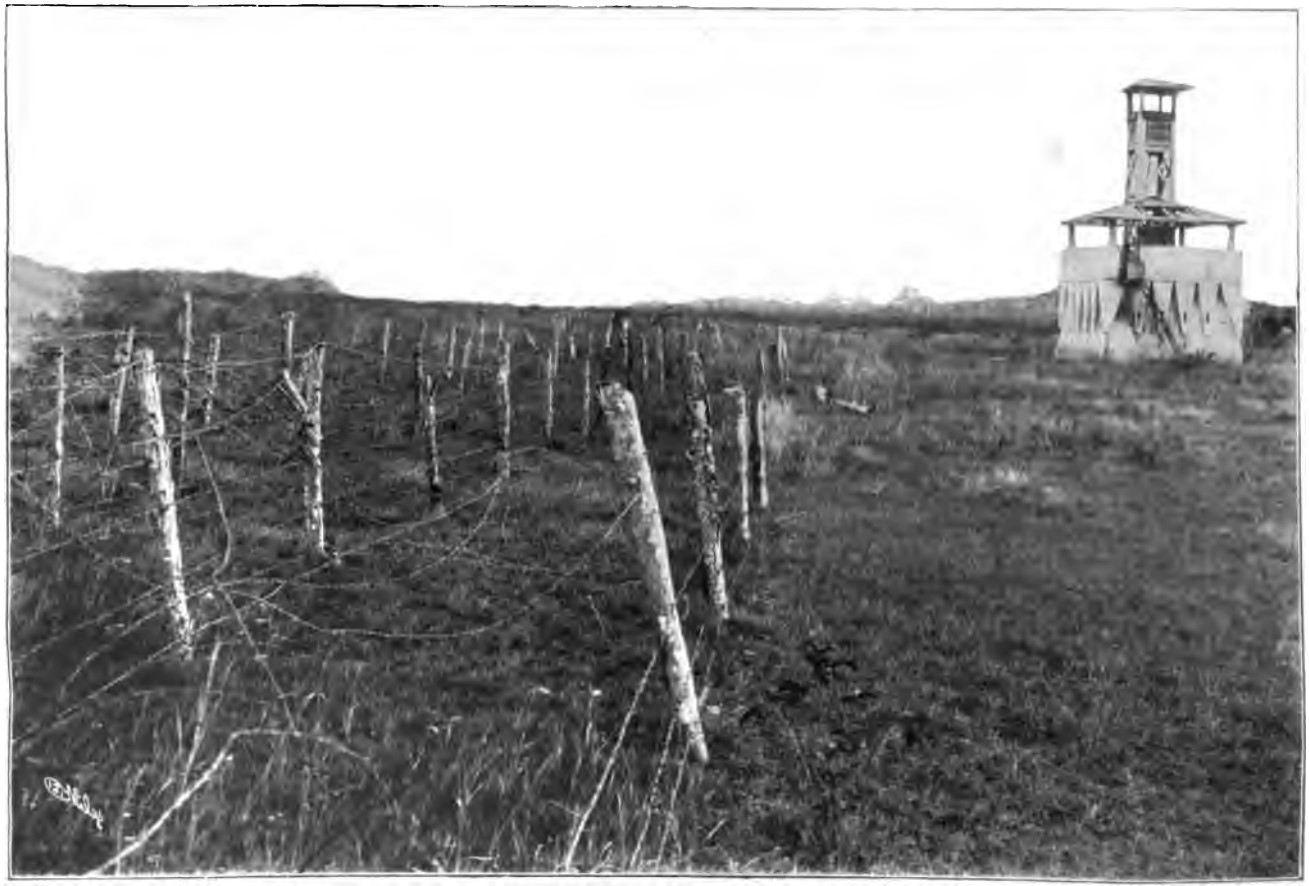
SIR: Pursuant to instructions from your office contained in an official copy of a letter from the military governor of the island of Cuba, dated December 26, 1900, I have the honor to submit the following report of work done under my supervision during the six months from July 1 to December 31, 1900, inclusive.

During this time I have been on duty as engineer officer, department of Habana and Pinar del Rio, from July 1 to July 23; as engineer officer, department of western Cuba, from July 23 to November 15; and as assistant to the chief engineer, department of Cuba, with station at Quemados, from November 15 to December 31.

Upon the breaking up of the department of western Cuba a final report was submitted to the commanding general of that department, covering work done during the fiscal year up to that date, and consequently part of the work reported upon here has previously been reported upon to him, and is included in his final report dated November 15, 1900.

The following is a list of work which has been under my charge: First, the continuation of the Columbia Barracks and Vedado road; second, roadwork in the

Digitized by Google



BLOCKHOUSE, JUCARO-MORON TROCHA.

Digitized by Google

Digitized by Google

BOILER-IRON BLOCKHOUSE, JUCARO-MORON TROCHA.

Digitized by Google

Digitized by Google

post of Columbia Barracks; third, repair work on the Marianao and La Playa road; fourth, roadwork fronting the commissary and quartermaster storehouses at Quemados; fifth, survey work, looking to the making of a map of the provinces of Habana and Pinar del Rio; sixth, the sanitation of the towns of Marianao, Quemados, and vicinity.

FIRST.—COLUMBIA BARRACKS AND VEDADO ROAD.

Work on this road was continued between the Almendares River and the Colon Cemetery. Six hundred and ninety-eight linear meters of road were graded; 500 cubic meters of stone for metallings were delivered, and 300 linear meters of road were metalled. In addition to this, a temporary road was constructed from Station No. 14, as shown on the maps, to the eastern approach to the pontoon bridge; and 1,610 linear meters of seven-strand barb-wire fence were constructed along the right of way on the west side of the Almendares River, through the farms "Molina" and "Melendez," pursuant to agreement with the owner of these farms by which he gave right of way free of charge to the public.

The following statement gives in detail the allotments of money for this road, and cost of specific parts:

Financial statement of Columbia Barracks and Vedado road.

Debtor:			
Cash on hand at beginning of fiscal year			$3,329.17
July 23, received by allotment			1,000.00
August 11, received by allotment			3,044.13
September 2, received by allotment			3,904.07
September 7, received by allotment			2,115.00
September 27, received by allotment			370.00
November 30, received by allotment			40.00
December 3, received by allotment			41.00
Total			13,843.37
Credit:			
July 2, transferred to Marianao and Rincon road			779.92
July 5, transferred to machinery account			25.00
July 7, transferred to treasurer island of Cuba			160.99
August 13, transferred to Santiago de las Vegas pumping plant			170.00
			1,135.91
Outstanding liabilities at end of fiscal year which have since been liquidated: for labor		$1,900.90	
Expenditures:			
For stone—			
Salvador Tramun	$1,045.40		
M. J. Morales	108.00		
J. G. Phillips	423.60		
		1,577.00	
Incidental expenses of small amounts, covered by certificates of officers in charge of work where it was impracticable to obtain vouchers		38.07	
Purchase of material for culverts—			
Frederico Kohly	$13.50		
J. B. Clow & Co	119.06		
Marianao Railway Co	82.65		
		215.21	
For purchase and setting of trees along road—			
Francisco Carballo	51.00		
Jose Armand & Sons	678.00		
		729.00	
Hardware, tools, etc.—			
Torres & Co	137.30		
Torres & Co	7.10		
Torres & Co	21.05		
Knight & Wall Co	15.00		
Knight & Wall Co	120.48		
Marina, Sierra Co	81.50		
Marina, Sierra Co	50.25		
		432.68	
Purchase of coal—			
Barrios & Coello	28.00		
Barrios & Coello	217.00		
		245.00	
Blacksmithing, Patrick Callahan		3.85	
			5,141.71
For maintenance of bridge July 1 to December 31			194.76
Leaving balance for construction work of			7,370.99
			13,843.37

Digitized by Google

This balance has been disbursed as follows:

For completing road on west side of river, from post of Columbia Barracks to crest of hill leading to river, July 1 to August 8, inclusive:		
Labor	$265.61	
Hire of teams	110.00	
Purchase of material	26.02	
		$401.63
Construction of 7-strand barbed wire-fence along right of way through farms Molina and Melendez		317.00
For grading 7,508 square meters of road on east side of river between Colon Cemetery and Almendares River, including work on temporary road leading from permanent road to pontoon bridge at 31$\frac{1}{10}$ cents per square meter finished road		2,788.18
For purchase of 500 cubic meters of broken stone delivered on road, at $1.85 per cubic meter		925.00
For laying this stone on 689 linear meters of road (depth 15 cubic meters, width 6 meters), and rolling 300 linear meters		411.58
Balance on hand December 31		2,527.60
		7,370.99

SECOND.—ROAD WORK IN THE POST OF COLUMBIA BARRACKS.

A stone roadway 5 meters in width in the western part of the post, connecting the main road in front of the officers' quarters at a point near the site of the artillery administration building with the road leading from Marianao to Marianao Playa, was graded and covered to a depth of 10 inches with large-sized stone, which was afterwards broken up in place with hammers, and rolled down with a steam roller. This road is 506 linear meters long.

Its cost was as follows:

For material for culverts	$47.72
Hire of teams	415.50
Purchase of supplies for road roller	50.00
Purchase of coal	21.01
Miscellaneous expenses, covered by voucher of officer in charge of work	.74
Making a total of	1,009.27

This being an average cost of 43.2 cents per square meter of road constructed.

During the months of September, October, and November the road work which was carried on in the post of Columbia Barracks was under charge of the regimental quartermaster of the Seventh Cavalry. During this time, by direction of the department commander, a road roller and a rock-crushing plant were furnished by the engineer officer for use on this work.

Expenses on account of this plant were as follows:

September:		
For labor paid		$243.70
Outstanding liabilities		50.00
Total		293.70
For supplies furnished rock crusher and road roller	$22.71	
For coal	21.01	
Total		43.72
Making a grand total of		337.42

During the months of November and December road work was carried on by this office in the eastern portion of the post in the continuation of the Columbia Barracks and Vedado road. This work consisted in the rectification of a grade which had been improperly constructed by post labor. The whole grade has to be gone over and the road properly crowned and metaled.

The cost of this piece of work has been as follows:

Regrading 1,000 linear meters of road, 9.12 meters wide, at 22.35 cents per square meter	$1,341.29
Metaling 333.8 linear meters of road, 6 meters wide, or 2,002.8 square meters, at 58.4 cents per square meter	1,171.23
Quarrying and delivering to crusher 135 cubic meters of stone, on hand December 31, at $1.203 per cubic meter	162.39
Total	2,674.91

RECAPITULATION.

For construction of road in western part of post	$1,009.27
Labor and material furnished regimental quartermaster Seventh Cavalry	337.42
Reconstruction of road in eastern part of post	2,674.91
Total	4,021.60

Of this sum $3,195.21 has been disbursed, and $826.39 remains as outstanding liabilities.

Digitized by Google

The statement of allotments and disbursements on this road is as follows:

Allotment:	
September 7	$1,165.00
September 27	1,963.75
October 9	333.75
October 17	250.80
November 30	105.60
December 6	149.90
Total	3,968.80
September 26, amount turned into treasury	333.75
Disbursements as above indicated	3,195.21
Balance on hand December 31	409.84
Total	3,968.80
Estimated deficit December 31, covered by January estimate	416.55

THIRD.—REPAIR WORK ON THE MARIANAO AND LA PLAYA ROAD.

This road was repaired near the post hospital, Columbia Barracks, and also near the tannery de Fe on the east side of the Marianao and La Playa road, about halfway between Quemados and La Playa. At these points the road was re-covered to a width of 5 meters with broken stone.

The total number of linear meters repaired was 427, or 2,135 square meters, at a total cost of $1,125.23, being an average of 52.7 cents per square meter of road repaired. There remained on hand on December 31 on account of this road $3,968.34, with which it is proposed to continue the repair work throughout its length.

FOURTH.—ROADWAY FRONTING COMMISSARY AND QUARTERMASTER STOREHOUSES AT QUEMADOS.

A stone roadway 9.15 meters wide was constructed in front of the post commissary storehouse at Quemados. This entailed the excavation of 167 cubic meters of earth and the laying of 556 square meters of macadam, at a total cost of $304.40, or 58.4 cents per square meter of completed road. In addition to this, 100 cubic meters of earth were excavated in front of the post quartermaster storehouse and 56 cubic meters of stone placed in the construction of a similar road at that place. This work was done by labor furnished by the engineer officer, with teams furnished by the post quartermaster, the total cost being $11.50.

FIFTH.—SURVEY WORK, LOOKING TO MAKING A MAP OF THE PROVINCES OF HABANA AND PINAR DEL RIO.

During the months of November and December one field party from this office has been working in and around the harbors of Mariel and Cabanas, in the province of Pinar del Rio, mapping that district. The total expenditures on this account are shown by the following financial statement:

For purchase of material	$13.64
For boat hire	28.00
For hire of teams	36.00
For services of survey party	222.00
Total	299.64
Outstanding liabilities:	
For services	249.00
For boat hire	37.25
For rent of house	7.65
For material	1.15
Total	295.05
Grand total	594.69
Divided as follows:	
Work at Mariel	494.39
Work at Cabanas	100.30
Total	594.69

At Mariel 20.82 square miles were mapped, at an average cost of $22.75 per square mile.

Digitized by Google

SIXTH.—SANITATION OF THE TOWNS OF MARIANAO AND QUEMADOS.

The sanitary work in the towns of Marianao, Quemados, and vicinity, from July 1 to November 15, was under charge of Maj. R. Echeverria, surgeon, United States Volunteers, whose estimates were submitted for the approval of the engineer officer.

From November 15 to December 31 the work was continued under Dr. Echeverria as a civilian employee of the military government, working under the supervision of the engineer officer. The report of Dr. Echeverria on this work is hereto appended.

In this connection attention is respectfully invited to the low death rate during the last six months in this municipality.

The streets are clean, and the town in good sanitary condition.

Very respectfully, your obedient servant,

H. F. JACKSON,
First Lieutenant, Second Artillery, Assistant Engineer.

The CHIEF ENGINEER, DEPARTMENT OF CUBA.

OFFICE MILITARY SANITARY OFFICER OF MARIANAO,
Quemados, January 23, 1901.

SIR: In compliance with your instructions of January 19, I have the honor to submit the following report of the functions of the military sanitary department of the municipality of Marianao for the period of July to December, 1900.

A report of similar import was made to the chief surgeon of the Department of Western Cuba for the period from July to October, 1900, upon the discontinuance of that department, and necessarily a part of this is an iteration of that report.

During the period for which this report is rendered there were 3,041 houses inspected, and of these 793 were found in such condition as to necessitate the serving of written notices to the effect that if sanitary rules were not observed fines would be imposed, and it was necessary to impose 58 fines, each for the amount of $5, in all aggregating the sum of $290. Seventeen of these fines, amounting to $85, were remitted upon presentation of valid reasons for such clemency. But to keep the houses and premises in a condition of ordinary sanitary cleanliness it has been found necessary to make inspection after inspection at intervals of not less than six weeks. The occupants, after the first splurge into cleanliness, which for the moment from its novelty pleased them, show an apathy as to the conditions of their surroundings, and lapse into their old-time carelessness and indifference, and grow restive under the constant supervision found necessary to keep them anywhere near the mark deemed essential for the preservation of the health of the community at large.

Civil Orders, No. 1, from headquarters Department of Habana and Pinar del Rio dated May 3, 1900, has had but little attention paid to it by the alcalde of the municipality, though the requirements of the provisions of same were several times brought to his notice.

The department cleaned cesspools, privy vaults, etc., for 22 private individuals, at a cost $210, bills for which were transmitted to the parties interested, and the alcalde was notified of the fact in each instance that he might collect them. In most cases this has been attended to by him.

During this period 19 cases of yellow fever came under the notice of the department in subjects residing within the municipality, but, with the exception of one case, the origin of which could not be definitely determined, all were known to have been visiting in Habana or elsewhere a short time previous to their being taken sick.

The municipality has been singularly free from diseases of an infectious nature, and, with the reported cases of yellow fever excepted, there were only a few sporadic cases of diphtheria noted.

In addition to the necessary disinfection and sanitary cleansing of infected houses and premises the department has had under its supervision the detention camp for nonimmunes at Buena Vista until September 8, when the necessity for its existence being no longer apparent it was ordered discontinued.

The general routine work of the department has been the maintenance of proper police for the streets and alleys of the municipality, and to some extent the repairing of same; the weekly attention to the emptying and disinfection of 52 cans, used as receptacles for night soil, at La Playa de Marianao, where there are no privy vaults, and, in fact, constant general attention to the minor details of police work that has served to place the municipality in its present good sanitary condition.

Digitized by Google

In addition to caring for the general sanitary conditions at Marianao the barrios of Ceiba and Puentes Grandes are under the jurisdiction of this department, for purposes of sanitary inspection and disinfection of infected houses and premises only, and it has been necessary from time to time, at the request of the alcalde of these, to remove accumulations of garbage deposited on vacant lots at those places by unauthorized parties, which were a menace to the general health and incidentally to Columbia barracks.

Upon request the yellow fever wards, receiving and other wards of the hospital, some troop quarters, stables, and workshops in Columbia Barracks were disinfected.

In all, there were 8,068 loads of refuse material disposed of.

The inclosed table shows the relative mortality for the corresponding six months of the preceding nine years. For the years 1891, 1892, 1893, and 1894 no accurate census is obtainable, and the death rate per thousand can not be given, but the population was presumably then not very variable from the years immediately following.

Of course the condition of the country during the years 1896, 1897, and 1898 militated against normal health conditions, but the preceding year and the year 1899, an unusually healthy year all over the island, may be taken as fair criteria.

Employees: There were employed by the department 1 clerk, 1 interpreter, 1 overseer, 3 foremen, 8 drivers, 1 night watchman, 1 office boy, and an average of 25 laborers.

Maintenance: Allotments for this purpose were made as follows on estimates submitted:

July	$3,061.00
August	2,500.00
September	1,706.00
October	1,763.00
November	1,621.00
December	1,582.90
Total	12,233.90

This amount was paid out on vouchers by the disbursing officer of the department, from whose office I ascertained that on December 31 a balance of $897.15 remains on hand. Expenses included transportation, labor, skilled and unskilled, cooks, nurses, mechanical appliances for disinfection, disinfectants, stationery, etc. The nonexpendable property purchased is all on hand, and with few exceptions is in serviceable condition. There is also quite a supply of disinfectants on hand.

Very respc ᵗfully,

R. ECHEVERRIA, *Sanitary Officer*

Death rate in the municipality of Marianao, Cuba, in the months July, August, September, October, November, and December, for the years 1891 to 1900, inclusive.

Months.	1891.	1892.	1893.	1894.
July	20	21	22	42
August	14	10	10	24
September	15	15	13	19
October	14	19	13	13
November	12	11	13	15
December	18	12	9	25

The population for the above years is not obtainable.

Months.	1895.		1896.		1897.	
	Number.	Rate per 1,000.	Number.	Rate per 1,000.	Number.	Rate per 1,000.
July	14	2.49	55	9.19	58	10.32
August	20	3.56	96	17.09	74	13.18
September	12	2.14	52	9.26	80	14.24
October	15	2.67	86	15.31	81	14.42
November	15	2.67	70	12.46	73	11.21
December	12	2.14	45	8.01	77	13.70

Population during the above years, 5,617.

Digitized by Google

Death rate in the municipality of Marianao, Cuba, etc.—Continued.

Months.	1898.		1899.		1900.	
	Number.	Rate per 1,000.	Number.	Rate per 1,000.	Number.	Rate per 1,000.
July	73	8.19	21	2.35	15	1.66
August	113	12.68	24	2.70	19	2.13
September	163	18.29	16	1.79	6	.67
October	99	11.10	21	2.35	13	1.45
November	87	9.76	20	2.24	11	1.23
December	100	11.22	12	1.34	6	.67

Population during the above years, 8,912.
Total number of deaths for the six months, 70; rate per 1,000, 1.27.

ASSISTANT ENGINEER, DEPARTMENT OF CUBA,
Quemados.

APPENDIX F.

HEADQUARTERS DISTRICT OF SANTIAGO,
OFFICE OF ENGINEER OFFICER,
Santiago de Cuba, February 19, 1901.

SIR: In compliance with instructions of your office, dated Habana, December 26, 1900, I have the honor to submit report of operations of the engineer department, for the period July 1 to December 31, 1900.

In compliance with General Orders No. 18, Headquarters Department of Santiago and Puerto Principe, July 16, 1900, I relieved First Lieut. R. L. Hamilton, Fifth United States Infantry, acting engineer officer, on the 19th of July. A large amount of work was being carried on, and all that had been started I had to push to completion. Limited to location, plans and character of work by selection of my predecessor, but also greatly assisted by the work that had been done and by studying it, I was able to make improvements that I could not have made had I not had the benefit of his experience. I found it necessary to reorganize the department and issue the circulars hereto appended. The matter of time-keeping was carefully gone over and modified as shown in appended circular. The method and time of payment had no consideration of the work being done, and by consultation with the disbursing officer, a fixed day (Saturday afternoons) was agreed on for paying outside of city work. All men were required to be present except sick and those discharged through no fault of their own, resulting in a great saving of time on the work and in the disbursing office.

The matter of purchasing for the department was taken up as soon as possible. The purchasing agent was not under the engineer officer and the peculiar situation existed of another department making purchases, to the correctness and justness of which I had to certify, and for the economy of which I was responsible. The system was tolerated until clear cases of delay and unsatisfactory buying were established, and then application made to do my own buying. While still hampered to a small extent by independent purchasing agent, I am now managing by special authority to get the material suited for the work for which required and at lower prices than formerly and promptly.

The small force for the work required makes it impossible for me to give a new project the study and planning that is usually given by an engineer, and I have had to do the work as a military engineer, taking the force and material available and doing promptly the best I could with it. Consequently much of the work has been put in on verbal specifications, and plans and specfications drawn up afterwards; a great many have yet to be completed. The plans of the office are consequently meager.

The following projects have been in charge of the department and are reported on in the order mentioned: Engineer force, office supplies, Guantanamo waterworks, Santiago waterworks, raising settling basin, repairing dam, Boniato; experimental well, San Juan River; Santiago street repairs, paving Heredia street hill, paving

Digitized by Google

Marina street, Sagarra-Dolores drainage, printing Santiago city maps, harbor improvements, asphalt paving, Santiago sewer system, Santiago-San Luis road, El Caney road, road repairs, Cobre trails, and Nispero wharf.

Engineer force:

Total allotment, six months ending December 31, 1900	$7,130.00
Total expenditure, six months ending December 31, 1900	6,919.25
Balance to credit of disbursing officer	210.75

This force has carried on the routine work of the office, drawn up plans and specifications and estimates for distributing system, town of Guantanamo; for the Santiago sewer system; for proposed asphalt work; details of sewer along Cristina, and examined and passed on all plans of details of work in progress. It has made up all rolls, vouchers, etc. Return of employees inclosed.

Office supplies:

Total allotment, six months ending December 31, 1900	$675.87
Total expenditure, six months ending December 31, 1900	655.09
Balance to credit of disbursing officer	20.78

The above allotment was used for the purchase of regular office supplies, including record books, file boxes, drawing paper and material, photographic supplies, identification checks, office blanks, etc., and the printing necessary for the same. The above expense includes 7 cents paid for custom duties.

Guantanamo waterworks:

Total allotment for six months ending December 31, 1900	$73,523.53
Total expenditure for same period	32,205.30
Balance to credit of disbursing officer	41,318.23

The cost of the work prior to July 1, 1900, was $111,447.18, and total cost to January 1, 1901, $144,652.48. Work done was as follows:

In July pipe line completed from Guantanamo to 100 feet of dam. All concrete work on pipe line completed except river crossings Nos. 3 and 4, which has been prevented by high water. Concrete foundation of dam put in, eleven courses of lower face and one of upper in place, and interior filled with concrete. All necessary stone was quarried.

In August work continued on dam, 160 cubic yards masonry laid, sluice finished, gate put in, and old flume torn out.

In September, owing to flood from 1st to 10th of month, no work could be done in that time. From 10th to 30th men were employed in repairing auxiliary works, such as tunnel and railroad track, and recovering tools from river. Work was continued on settling basin, pipe line laid from dam to basin, and back filling done on pipe line, amounting to 5,445 feet; 11¼ cubic yards stone laid and 26¼ cubic yards of concrete. Early in month cable was received from agent in New York stating that pipe was down 30 per cent, and attempt was made to take advantage of the market by asking for $25,000 to purchase pipe for distributing system in town, but owing to guarded system allotment could not be made at once. Detailed estimate for pipe amounting to $28,152.78 was submitted, but to date nothing has been heard of money. While it is not doubted that it was not possible to allot this amount at once, attention is called to the matter to show the inability of the government to compete with individuals in purchasing.

In October, owing to continued high water over dam, this work has been constantly interrupted and had to be confined almost entirely to building settling basin and back filling, consisting of following work:

On dam, 94 cubic yards stone laid; on settling basin, 37¼ cubic yards concrete laid; on pipe line 7,800 lineal feet back filling.

Plans were also drawn up for valve bridge and preparations made to erect bridge. A large amount of repair work was done on tools lost and damaged in September floods.

In November order for pipe and material for distributing system in the town was placed in hands of the Pittsburg testing laboratory, limited (Chambers & Hone, agents); they to purchase and test pipe and material at factory and inspect it alongside ship either New York or Mobile, for 5 per cent of cost of material. Considering that formerly no material was tested or inspected, resulting in the department having to suffer the loss due to breakage and accept anything sent, I consider this the best method available to the department, both from an engineering and business point of view. The matter of placing a standpipe on the barrack hill has been taken up and proposals accompanied by plans and specifications invited from several of the largest firms in the United States, resulting in an offer from the Warren City Boiler Works to build and put up a standpipe, 405,000 gallons capacity, at Guantanamo, for the sum of $6,225, exclusive of freight and duty. The plans and specifications are being studied, and in case they are found suitable and the best that can be obtained, they will be accepted.

Digitized by Google

Work has been continued on dam, settling basin, valve houses, air-valve boxes, piers for gate bridge and back filling; amounting to 43½ cubic yards stone in dam; 76¼ cubic yards concrete in bridge, piers and gatehouse, and 1,550 linear feet back filling.

In December, No. 4 and No. 5 gate houses completed. Iron doors to gate houses made and put on. Timber and forms cleared away and work generally cleared up. Gatekeeper's house was framed, and air valves Nos. 1, 2, and 3 set. Pipe from tunnel to dam concreted up.

Santiago waterworks:	
Total allotment allowed 6 months ending December 31, 1900	$20,963.00
Total expenditure during same period	8,821.02
Balance to credit of disbursing officer	12,041.98

Work done consisted in repairing breaks, replacing old worn out pipe, making house connections, care of plant, inspection of pine line, and placing water pipes under streets to be asphalted. In August, 1,200 feet main line were taken up, cleaned, and relaid, vegetable matter cleaned out for 2,000 feet above dam, and reservoir yard cleaned. In September, owing to heavy rains washing out and exposing pipe, numerous repairs were necessary and were made. In October, 175 feet old pipe were laid, 307 feet new pipe laid, and 1,073 feet ditch opened. In November, five house connections were made, 435 feet new pipe laid, 321 feet old pipe laid, and 1,297 feet ditch opened. The usual large number of breaks due to old pipe were repaired, line guarded, and settling basin cleaned out twice.

In December, making house connections and repairing broken pipe, required the laying of 309 feet of new pipe and relaying 567 feet old; the trenching required was 1,165 linear feet. The lead joints made required 453 pounds lead. The usual amount of miscellaneous work, such as cleaning valves, lowering and covering pipes, etc., was done. In December was also started the work of piping the streets to be asphalted. Work done on Marina street required 50 cubic yards of excavation, laying 123 feet galvanized pipe, cutting out 11-inch pipe, and putting in 12-inch valve. Jaguey street, 262 cubic yards excavation, 650 feet of 4 inch pipe laid and jointed, 300 feet galvanized-iron pipe laid and jointed.

This special work, under streets to be asphalted, cost:

For labor	$550.47
For material	1,122.35
Total	1,672.82

This amount, deducted from the total expenditure for the six months, gives for the cost of maintenance of the water system and making house connections, $7,148.20, or an average cost per month of $1,191.37. Under the streets permanently improved mains and laterals are laid to conform to general water system of the town, calculated on 50,000 population and 75 gallons per head, or 3,750,000 gallons.

Raising settling basin, total allotment allowed	$2,000

Plans have been drawn up and special fittings to connect pipe line with dam so as not to interrupt flow of water in city during the work ordered. It is calculated that by raising settling basin 5 feet, the daily supply of water will be increased by 23,000 gallons.

Owing to demands made on engineer force by sewer work, an engineer had to be sent for, and this work will be started on his arrival.

Repairing Boniato dam and putting in sluice gate, total allotment	$2,450

Proposals for gate have been received, and gate as modified ordered. Work will commence on arrival of gate.

Experimental well, San Juan River:	
Total allotment allowed	$1,000.00
Total expenditure	1,182.95
Deficit	182.95

The city of Santiago gets at the present time, dry season, barely 5 gallons per head per day. In the rainy season there is plenty of water in the Boniato River, but owing to incrustation of pipe its carrying capacity is reduced from 11 inches to 8, so that the people never get more than one-tenth of their proper supply. If the Boniato River could at all times give a proper supply, to take up and replace the old pipe by new 24-inch pipe would be the simplest solution, but it does not. A number of schemes have been investigated. There is good reason to believe that an abundant supply of water can be obtained from artesian wells along the south coast of Cuba, from Guantanamo to the mouth of the Cauto, but no businesslike proposi-

Digitized by Google

tion for developing it at Santiago has been obtained, and I am reluctant to load up with well-boring machinery and attempt it with the labor at hand. An examination of the San Juan Valley shows a large gathering ground drained by the San Juan River, the flow of which is comparatively small. Consequently there must be a large subterranean stream. The valley converges into a gorge two miles north of the mouth of the river, large lagoons drain into the river just above the gorge, and it was decided to put in wells above the outlet of the lagoons, get into the water-bearing strata, then tunnel under the river, intercept the subflow, and pump it into the old reservoir, which will hold a day's supply for the town below it, and into a standpipe to be erected in the old cemetery, for supplying the upper portion of the town.

In November a box well was carried to a depth of 12 feet and a pump of 300 gallons capacity put in and well carried to depth of 14 feet; the inflow of water then became such that the pump could not lower it and an old pump found at the Boniato reservoir was repaired and put in. This pump has a capacity of 500 gallons. The two pumps kept the water down for two days and until the well had reached a depth of 17 feet; again the flow of water became too great for the pumps to handle. A few days before this condition was anticipated, an old well-boring machine, the property of the Spanish Government, was found at Boniato and repairs started on it and broken parts and necessary tubing cabled for. On arrival of necessary material drive wells will be sunk and investigation continued. The experiments so far indicate all that was anticipated, and I consider it a question of but a short time and comparatively small cost to give Santiago a sufficient supply of good water. So far the old abandoned machinery that would not have been noticed but for this need is worth more that the amount expended.

Santiago street repairs:

Total allotment, six months ending December 31, 1900	$19,003.00
Total expenditure, six months ending December 31, 1900	9,567.41
Balance to credit of disbursing officer	9,435.59

July: Santa Rita street hill, west of La Virgen, was paved and drains under Alameda cleaned. Pavement of Santo Tomas, between Enramadas and Concha road, was repaired, and Barracones street near Trocha. Storm drains near San Juan Nepomuceno and Trocha were cleaned out and erection of harbor dredge completed. Ditches around slaughterhouse were opened and cleaned and bowlder pavement on Carniceria repaired.

August: Work consisted in ditching and rounding streets, cleaning out ditch repaired, repairing and patching bowlder and macadam pavement.

September: Owing to heavy rains first ten days of September a large force was kept busy removing the banks of earth and stone deposited on asphalt streets. A large amount of pumping was required to keep dead-ended sewers open. Holes in manholes were plugged up with wood. These miscellaneous repairs cost $402.53; repairs to Marina street cost $237.51. Thirty cubic yards broken stone had to be placed and 50 cubic yards of concrete and stone to prevent further washing.

Other streets repaired were: Calvario street between Pelayo and Santa Rita, requiring 211.61 square yards paving and 250 cubic yards of fill, at a cost of $386.50; San Pedro street from Santa Lucia to Santa Rita, requiring 100 square yards bowlder paving and 65 cubic yards fill, cost $168.86; Carniceria from Concha road to Habana was repaired, requiring bridging at two places, at a cost of $281.13; San Juan Nepomuceno from San German to Trinidad, bowlder pavement, at a cost of $160.14; San German from Santo Tomas to San Juan Nepomuceno, bowlder pavement required 202 square yards, at a cost of $99.19; La Cruz road, rounding up and cleaning gutters after storm, at a cost of $170.73; Trinidad from San Juan Nepomuceno west, 105¼ square yards bowlder paving, at a cost of $50.15; Concha road put in passable condition, at cost of $449.26; Trocha road put in passable condition, at cost of $229.21; Enramadas from Calvario to San Agustin, repaired, requiring 49 cubic yards fill and 127 square yards bowlder paving, at cost of $204.93; care dredge, Santiago harbor, $16.50.

In October the following repair work was done: Enramadas between Dolores and San Agustin, 300 square yards bowlder pavement; Trinidad between San Juan Nepomuceno and Cristina, 251 square yards bowlder pavement; Concha from Dolores to Trocha, 384 lineal feet road graded and gutters formed; Calvario between Rey Pelayo and Santa Rita, 215 square yards filling and paving street; Calle Nuevo, hole in culvert repaired; Alameda, culvert repaired; Hospital, drain from jail repaired; Barracones, from Heredia to Ayuntamiento, catch-basins and drains built.

In November Heredia street hill was completed; the cost was as follows:

Labor	$696.16
Material	2,378.15

Digitized by Google

This street was constructed under the following specifications:

Street between Animas and Hospital to be brought to a uniform grade of 12.63 per cent, cross section between curbs to be 18 feet wide and have 4-inch crown. On subgrade, when properly shaped (being of soft lime rock, rolling and tapping was not necessary), to be placed a foundation of 4 inches of Portland cement concrete, in proportions of $\frac{1}{2}$ and 7; upon this foundation to be placed a cushion of 1 inch of clean beach sand, upon which brick will be laid in usual manner, leaving open joints of $\frac{1}{8}$ inch; joints to be filled with asphaltic cement for 15 feet from Animas street, as an experiment; on balance of work joints to be filled with Portland cement grout, in proportion of 1 of cement and 2 of sand by measure. Curb to be Portland cement concrete, in proportion of $1\frac{1}{2}$; dimensions 6 by 9 inches. Time required for work, one month, October 24 to November 23, and consisted in the following work.

259 cubic yards excavation, at $1.3606		$352.40
85.33 cubic yards concrete, at $8.336		713.85
Made up as follows:		
85.33 cubic yards stone, at $1.75	$149.32	
34.4 cubic yards sand, at $2	69.00	
85.5 barrels Portland cement, at $3.60	307.80	
Labor, at $2.20 per cubic yard	187.73	
411 linear feet concrete curb, faced with cement mortar, at $0.4719 per lineal foot		193.95
Made up as follows:		
9.6 cubic yards crushed stone, at $1.75	$16.80	
4 cubic yards sand, at $2	8.00	
14.50 barrels Portland cement, at $3.60	52.20	
Labor	116.95	
729.5 square yards brick pavement, at $3.053 per square yard		2,226.99
Distributed as follows:		
43,015 brick, at $36.63	$1,575.64	
66.5 cubic yards sand, at $2	133.00	
15 sacks stone dust, at $1	15.00	
11 barrels asphalt tar, at $2.50	27.50	
29 barrels Portland cement, at $3.60	104.40	
Labor	371.45	
Sidewalk:		
Labor, 34½ cubic yards excavation, at $0.50		17.13
Labor, 152 square yards repairing with flags, at $0.1137		17.28
Material		2.51
Total cost improvement:		
Labor	$1,062.95	
Material	2,461.17	
		3,524.12
Total cost per square yard of improvement		4.831
Cost per square yard, excluding curb and sidewalk		4.511
Cost per square yard, excluding excavation, curb, and sidewalk		4.031

Labor amounted to 30.16 per cent of cost. Material amounted to 69.84 per cent of cost.

Attention is invited to comparison of proposals of Barber Asphalt Paving Company for similar work.

	Barber Asphalt Paving Co.	Engineer department.
Concrete curb, per lineal foot	$0.70	$6.472
Brick pavement, per square yard	4.50	4.031
Concrete, per cubic yard	9.50	8.336

Paving Marina street hill:		
Total allotment allowed		$6,050.00
Total expense to date, vouchers paid		2,179.75
Balance to credit of disbursing officer		3,870.25

This street, owing to its central location connecting the Muelle Real with the Plaza de Cespedes, from a consideration of the public, was the first to need attention, but owing to steep grade—13 per cent from Gallo to Hospital and 6 per cent from Hospital to San Juan Nepomuceno, and with large and costly buildings on either side—one of the most difficult. It had been repeatedly macadamized, and as often as rainy season came washed out. By constantly taking off the crest at Hospital, I finally got it down, so that by making a cut of 18 inches I obtained a 10.85 per cent maximum grade without too much damage to the property adjacent. The street is to be put in on following specifications: Concrete curbs; width between curbs from 24 feet to 28 feet to 16.5. Crown, 1 in 30; foundation of 4-inch concrete. On this 1-inch cushion of sand, and on this vitrified brick pavement laid with $\frac{1}{8}$-inch joints, with expanding joints along curb and up center, and crosswise every 20 feet joints of brick grouted.

Digitized by Google

GUASO SPRINGS, NEAR GUANTANAMO.

Digitized by Google

Digitized by Google

GUANTANAMO WATERWORKS.

Digitized by Google

Digitized by Google

GUASO WATERWORKS AT GUANTANAMO.

Digitized by Google

Digitized by Google

LAS NINFAS DAM.

MOUTH OF CAVE FROM WHICH RIVER EMERGES.

Digitized by Google

Digitized by Google

CLEARING RIVER BED ABOVE SLUICE.

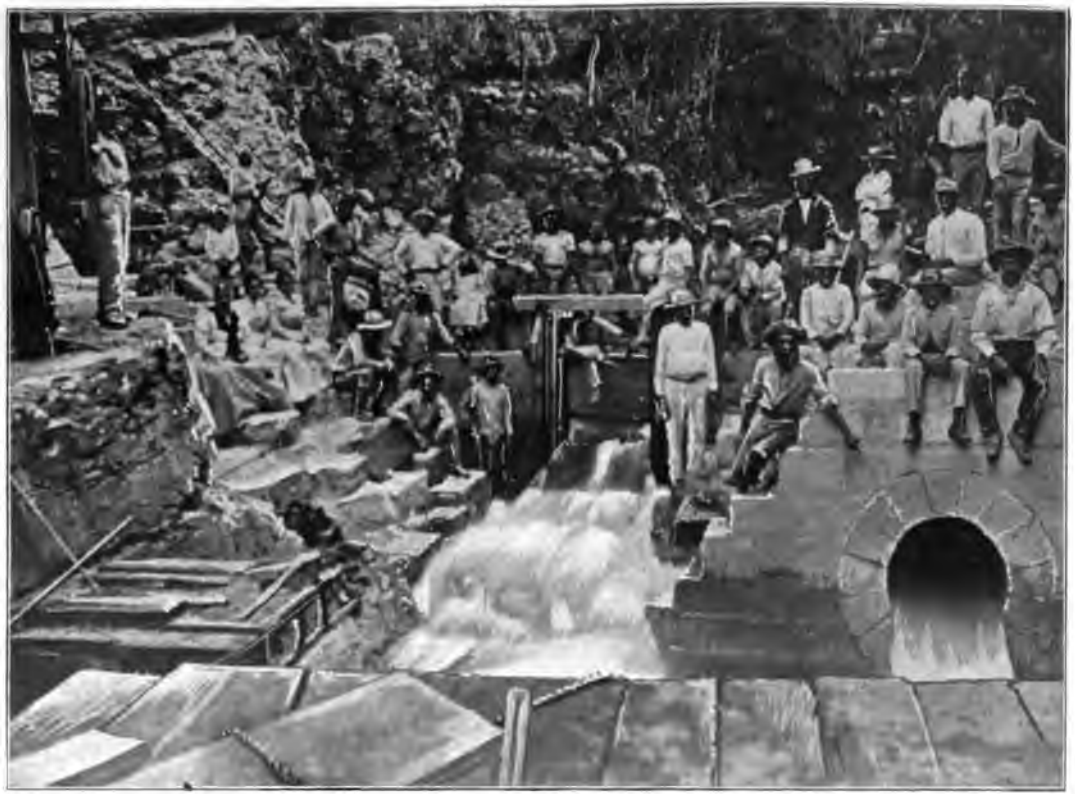
Digitized by Google

Digitized by Google

FLUME, PUMP, ETC., JUST BEFORE TURNING WATER THROUGH SLUICE, AUGUST 26, 1900.

Digitized by Google

Digitized by Google



FLUME REMOVED. PLACING COFFERDAM, AUGUST 27, 1900.

Digitized by Google

Digitized by Google

GUANTANAMO WATERWORKS.

VALVE HOUSE NO. 2.

Digitized by Google

Digitized by Google

VIEW BELOW DAM. REBUILDING TRACK. WATER FLOWING 14 INCHES OVER DAM, SEPTEMBER 17, 1900.

Digitized by Google

Digitized by Google

SAND BOX COMPLETE, EXCEPT PLANK COVER.

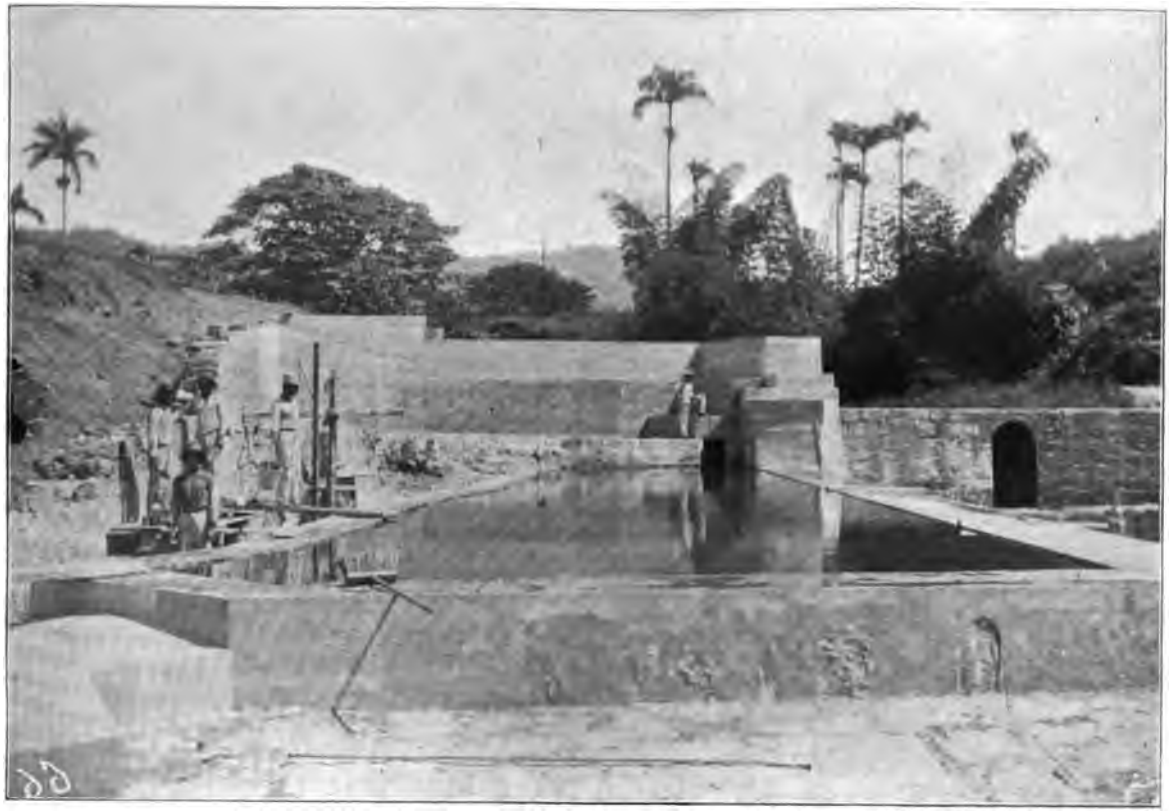
Digitized by Google

Digitized by Google

SAND BOX, LOWER SIDE, SHOWING OVERFLOW PIPE.

Digitized by Google

Digitized by Google



SETTLING BASIN, SANTIAGO WATERWORKS.

Digitized by Google

Digitized by Google

SAN JUAN WELL.

Digitized by Google

Digitized by Google

SAN JUAN WELL.

Digitized by Google

Digitized by Google

To December 31 the following amount of work has been done:

Excavation	cubic yards	813
Concrete	do	88½
Curb	linear feet	550
Cost of labor		$1,490.84
Cost of material		2,170.21
Total		3,661.05

Itemization of expenses will be given on completion of street.

Sagarra-Dolores drainage:	
Total allotment allowed	$6,000.00
Total expense	2,122.20
Balance to credit of disbursing officer	3,877.80

The original plans for this drainage contemplated a large semihexagonal paved ditch extending from Sagarra street along Dolores to the Concha, but on the decision to asphalt Santo Tomas it was decided to make a hollow street 16 feet wide, having a rise from center to curbs of 6 inches with curb of 8 inches high; fill in and give adjacent property drainage over curb into street, and for sanitary reasons grout the center for a width of 3 feet. Street was given a grade of from 1 to 3 per cent; thus the same volume of water could be carried and street be passable for traffic. By this work it is hoped to cut off the floods which in rainy seasons deluge the lower portion of the town. Work done to December 31 was as follows:

Establishing camp and organizing force	$29.40
Moving fences and establishing street line	59.20
Labor and cartage, grading	1,131.55
General expenses, engineer, foreman, clerk, transportation, etc.	266.51
Material	24.90
Total	1,511.56

Itemization of expenses will be given on completion.

Printing Santiago city maps:	
Allotment made	$760.00
Total expense	698.10
Balance to credit of disbursing officer	61.90
100 maps, scale 75 feet to 1 inch, were made, unmounted, at $3.60	360.00
Mounting 25 maps, scale 75 feet to 1 inch, at $6	150.00
100 maps, scale 150 feet to 1 inch, were made, unmounted, at $1.20	120.00
Mounting 50 maps, scale 150 feet to 1 inch, at $1	50.00
Duty and port charges on above	10.80
Duty and expressage on original drawing to United States	4.75
Duty and expressage on proof from New York to Santiago	2.55
Total	698.10

Several of these maps have been distributed to public and military officials, both here and in Habana; but it is thought all future needs can be met from those remaining on hand.

HARBOR IMPROVEMENTS.

Self-dumping barges:	
Total allotment allowed	$4,000.00
Total expense to date	4,522.12
Deficit	522.12
Expense made up as follows:	
Cables by North American Trust Company to Antwerp	25.62
Transference of 20,000 francs to United States consul-general, Antwerp	3,910.00
Transference of 3,000 francs to United States consul-general, Antwerp	586.50
Total	4,522.12
Asphalt pavement:	
Total amount authorized, plus duty	50,000
Total allotment to December 31, 1901	12,500
No expenditure to date.	

Bids for asphalt pavement were opened on the 1st of December and contract awarded to the Barber Asphalt Paving Company, who were the only bidders. Contract calls for the following streets to be asphalted, and it is expected that all will be completed by the end of June, 1901: Santo Tomas street, between Paseo de Concha and Trinidad street; Jaguey street, between Cristina and Hospital streets; Hospital street, between Jaguey and Sagarra streets; Sagarra street, between Hospital and San Juan Nepomuceno streets; San Geronimo street, between Hospital and San Juan Nepomuceno streets; Marina street, between Hospital and Santo Tomas streets; Trinidad street, between Cristina and Gallo streets and between Santo Tomas and Dolores streets; and San Juan Nepomuceno street, between Enramadas and Sagarra

Digitized by Google

streets. Specifications were as attached. Experience showed that neither the asphalt nor cement gutters would stand the water from the houses and constant traffic, and former specifications were modified to require brick gutters. Prices as per contract are as follows:

Excavation	per cubic yard	$0.70
Concrete curbing in place	per linear foot	.65
Vitrified-brick gutter in place	per square yard	4.40
Asphalt pavement in place:		
Class A	do	3.00
Class B	do	3.30
Class C	do	3.50
Stone headers in place	per linear foot	.25
Extra concrete	per cubic yard	9.00
Santiago sewer system:		
Estimated cost of approved project		$27,610.00
Allotment allowed to December 31, 1900		22,500.00
Total expenditure to December 31, 1900		1,870.17
Balance to credit of disbursing officer		20,629.83

On October 2 plans and general specifications for several schemes of sewerage were submitted, resulting in approval of following schemes: Discharging all sewage at northwest corner of city, northwest of slaughterhouse; running sewage through mechanical filters at this point and thence the cleared liquid into the bay. The advantages claimed for the system are: First, it provides a system of filters occupying small space and easily inspected and controlled; second, carries 50 per cent of sewage by gravity; third, fits improvements made in city and no improvements have to be destroyed; fourth, it has shortest length of large expensive sewer; fifth, it involves no private property, consequently no damage incurred; sixth, discharges on filters situated on swamp land unsuited for other purposes and of little value, and does not injure future extension of city.

Ultimate and final cost of sewering entire city under this scheme (based on double population and 75 gallons per head)	$327,610
Cost of work to be done at once estimated at	90,000

This work contemplates putting in the following:

Lateral sewers	7,469
Pumping district interceptor, force main and sea flush	13,000
Pumping plant, duplicate centrifugal pumps	5,000
Cost of land for pumping station	2,500
Interceptor from Trinidad and Rastro to Rastro and Concha	16,206
Outlet from Rastro to filter	13,780
1,040 feet of flumes 4 by 4	6,864
Sewering streets to be asphalted	25,000
Miscellaneous	181
Total	90,000

It will be noted that under the work to be done at once no provision is made for filters; these can be omitted till the system is ready to be put in operation and receive excrement.

As soon as the general scheme was approved, work on the detailed plans was started, but this was interrupted by the necessity of drawing up plans for sewers under streets to be asphalted and work of putting these sewers in before the pavement was started. Here, as elsewhere, the rush to do the work has not allowed the study or plans usually counted necessary, and I was in a dilemma either to stop work or get all excavation done before 1st of April. Doing work in this way requires incessant work on my part and generates the thought that the department is supposed to be superhuman every time an order is received to do more work. To my principal assistant engineer, Mr. A. S. Hobby, jr., and Mr. W. A. Wilson, resident engineer on city work, I am personally indebted for their patience and cheerfulness in doing more work than could reasonably be expected of them, and largely to them Santiago owes its improved condition to-day. Their work will bear favorable comparison with any that has been done in the Tropics.

In the latter part of November and December lateral sewers were put in Marina street, requiring 682 cubic yards of excavation, laying and joining 900 linear feet 6-inch sewer pipe, 62 feet 6-inch house connections, and 470 feet of 4-inch connections.

Jaguey street: Lateral sewers required 330 feet of 10-inch sewer pipe, laid and joined; 220 feet of 8-inch pipe laid and joined; 350 feet of 4-inch house connections laid and joined; 650 feet of 3-inch drain tile under sewer, surrounded with broken stone, to provide drainage for subsoil water. Order for pipe and sewer brick has been advertised for, and the accepting of bid and testing of material and delivery to me put in hands of Messrs. Chambers & Hone, of New York. As soon as material is en route proposals will be called for trench and laying.

Digitized by Google

SAN PEDRO STREET, NORTH FROM SAN ANTONIO.

Digitized by Google

Digitized by Google

HOSPITAL STREET, NORTH FROM JAGUEY STREET, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

HOSPITAL STREET, SANTA LUCIA TO HEREDIA, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

HOSPITAL STREET, SANTA LUCIA TO HEREDIA, PAVED WITH ASPHALT.

Digitized by Google

Digitized by Google

JAGUEY STREET, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

SANTO TOMAS STREET, NORTH FROM TRINIDAD, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

AN UNIMPROVED STREET, SANTIAGO.

Digitized by Google

Digitized by Google

HEREDIA STREET, ANIMAS TO HOSPITAL. BRICK PAVEMENT COMPLETED.

Digitized by Google

Digitized by Google

BUILDING ALAMEDA AT SANTIAGO.

Digitized by Google

Digitized by Google

SAN FELIX STREET AND CONCHA ROAD. CULVERT.

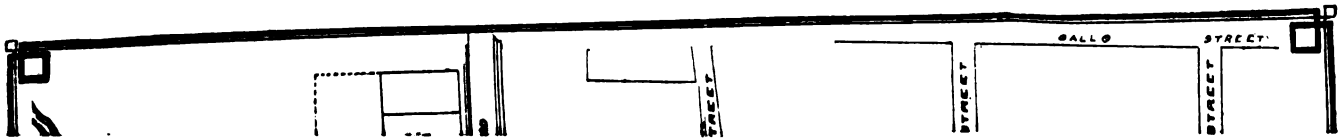
Digitized by Google

Digitized by Google

BUILDING ROAD TO THE SLAUGHTERHOUSE, SANTIAGO. TABLET IN MEMORY OF CREW OF "VIRGINIUS."

Digitized by Google

Digitized by Google

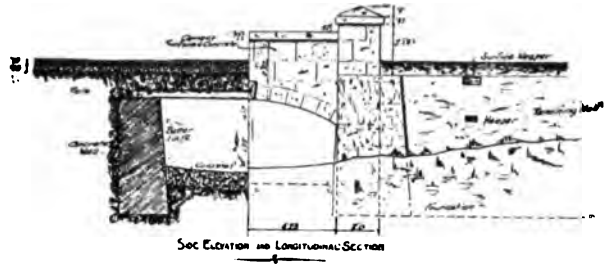


SECTION AT M-M.

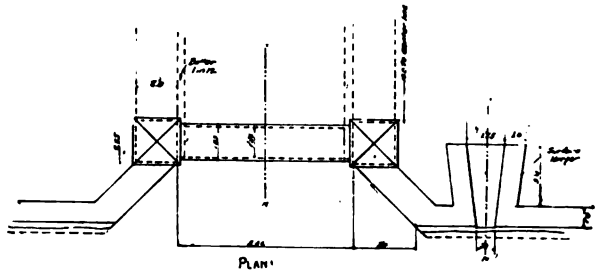
SECTION AT N-N.

Digitized by Google

Digitized by Google



Soc Elevation and Longitudinal Section



Plan

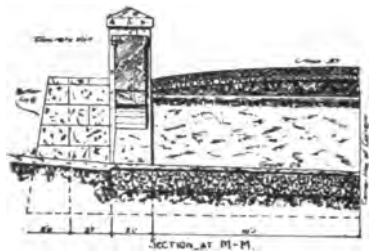
Department of Santiago and Puerto Principe

Office Department of Public Roads.

Details and Cross Sections of

Culvert and Retaining Walls

COBRE & CEMETERY ROADS.



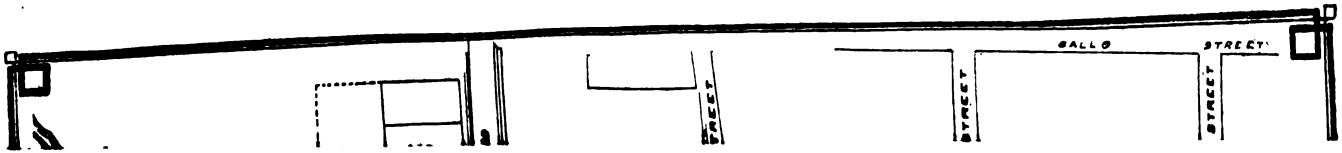
Section at M-M.

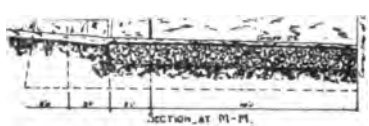
Section at N-N.

505

Digitized by Google

Digitized by Google



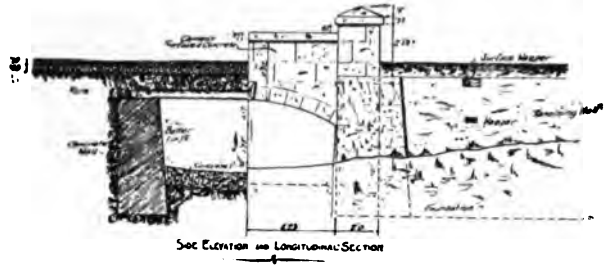


SECTION AT M-M.

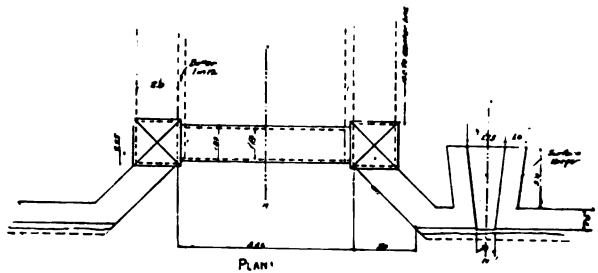
SECTION AT N-N.

Digitized by Google

Digitized by Google



Side Elevation and Longitudinal Section



Plan

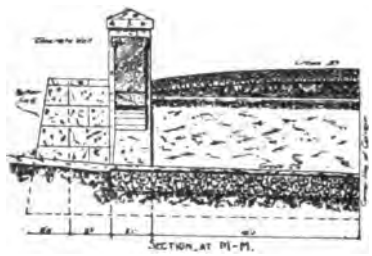
Department of Santiago and Puerto Principe

Office Department of Public Roads.

Details and Cross Sections of

Culvert and Retaining Walls

COBRE & CEMETERY ROADS.



Section at M-M.

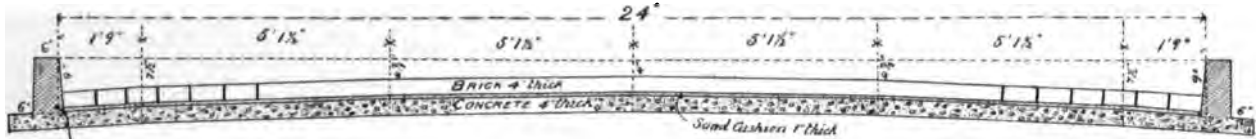
Section at N-N.

Santiago de Cuba,
March 1st, 1900.

Digitized by Google

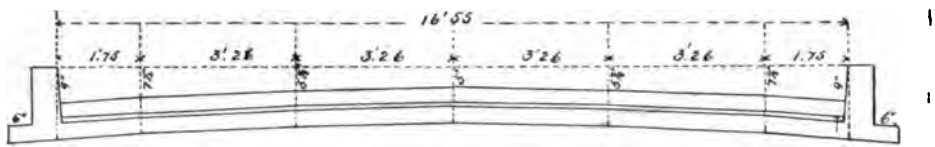
Digitized by Google

26ft has 6" Crown.

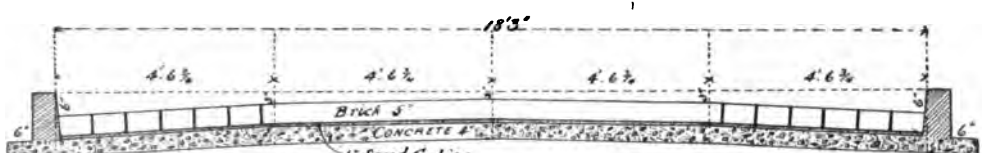


Asphalt Tar joints at Curbs and at 8's from center and cross joints 10' apart

Grade 10.85%

MARINA ST.

Grade 9.04%

MARINA ST.



Grade 12.63%

HEREDIA ST.

HILL 17.10 TO 19.40 WIDE.

Digitized by Google

Digitized by Google

MARINA STREET, WEST FROM SANTO TOMAS. PREPARING FOR BRICKS.

Digitized by Google

Digitized by Google

MARINA STREET, WEST FROM SANTO TOMAS. MACADAM PAVEMENT.

Digitized by Google

Digitized by Google

MARINA STREET, LOWERING GRADE AT HOSPITAL STREET.

Digitized by Google

Digitized by Google

DOLORES STREET, BETWEEN TRINIDAD AND MACEO.

Digitized by Google

Digitized by Google

DOLORES STREET, SOUTH FROM TRINIDAD, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

DOLORES STREET, NORTH FROM HABANA, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

SAGARRA STREET, HOSPITAL TO NEPOMUCENO, BEFORE IMPROVEMENT.

Digitized by Google

Digitized by Google

MUELLE REAL AND HARBOR DREDGE, SANTIAGO.

Digitized by Google

Digitized by Google

MARINA STREET HILL, SEWER WORK.

Digitized by Google

Digitized by Google

JAGUEY STREET, WEST FROM HOSPITAL. SEWER AND WATERWORKS.

Digitized by Google

Digitized by Google

JAGUEY STREET, EAST OF GALLO STREET. WORK ON SEWER AND WATER.

Digitized by Google

Digitized by Google

JAGUEY STREET, CHRISTINA EAST. WORK ON SEWER.

Digitized by Google

Digitized by Google

Santiago, San Luis road:	
Total allotment allowed to December 31, 1900	$116,503.00
Total expenditure to December 31, 1900	118,288.14
(Total expense, whether paid or not, included.)	
Deficit	1,885.14
Total expense for the period	120,685.67
Expended on—	
Santiago—San Luis road, section 2	30,963.19
Section 3	26,717.10
Section 4	62,985.38
Total	120,685.67

Section 2 begins at the first railroad crossing from Santiago and ends at railroad crossing, Boniato station; distance, 17,507 feet.

Total expense for period		$30,963.19
Wall masonry, 282.8 cubic yards, at $11.62	$3,387.86	
No. 11, bridge masonry, 224 cubic yards, at $15.69	3,515.91	
No. 12, bridge (pipe culvert)	107.90	
87 cubic yards fascine, at $7.29	634.85	
		7,646.52
Total		23,336.67

Length of section completed during period, 3,820 feet. Total number of square yards, 6,367.

Total cost of section completed:	
From previous reports—	
Total cost of road, exclusive of masonry	$62,201.27
Total cost of masonry and bridges	14,987.52
	77,188.79
Total length of section, feet	17,507
Total square yards section	29,180
Cost, exclusive of masonry, 29,180 square yards, at $2.18	$62,201.27
Cost, including masonry, 29,180 square yards, at $2.64	$77,188.79

Section 3 begins at railroad crossing, Boniato station, and ends at end of wall on top of mountain.

Total expense for period		$26,717.10
277.1 cubic yards wall masonry, at $8.82	$2,446.85	
2,634 linear feet channel, at 80 cents	2,107.72	
Work done on 49 basins	631.25	
Bridges Nos. 18 and 19	94.36	
Bridge No. 17	673.39	
General masonry	3,274.68	
		9,228.25
		17,488.85
Length of portion or part completed during period ..... linear feet		3,360
Total number of square yards in this part		5,600
Cost, exclusive of masonry, 5,600 square yards, at $3.12		$17,488.85
Cost, including masonry, 5,600 square yards, at $4.77		$26,717.10
Total cost of section completed:		
Total expense of section		$131,844.79
Total number of square yards in section		18,094
Cost, 18,094 square yards, at $7.29		$131,844.79

Section 4 begins at retaining wall, top of mountain, and extends toward Dos Caminos. (Uncompleted.)

Total expense for period		$62,985.38
Station No. 26, small wall (dry), 49.5 cubic yards, at $8.86	$438.79	
Station No. 74, large wall (dry), 703 cubic yards, at $5.40	3,797.33	
Bridge No. 20, 126 cubic yards, at $31.98	4,029.53	
Bridge No. 22, 145 cubic yards, at $20.60	2,987.50	
Bridge No. 23, 94 cubic yards, at $18.56	1,745.33	
Bridge No. 25	720.15	
Bridge No. 28	339.30	
		14,057.98
		48,927.45
Length of section completed during period ..... linear feet		10,966
Total square yards in section		18,110
Cost, exclusive of masonry, 18,110 square yards, at $2.70		$48,927.45

For specifications and details of this work see annual report department of Santiago and Puerto Principe.

This work has been under the superintendence of Mr. S. I. Wilkinson almost from the time of its inception, and he has proved himself a capable and efficient superintendent, with good ability as an organizer and executive manager. His assistant

Digitized by Google

engineers, Mr. N. P. Turner and Mr. W. W. Burden, have heartily cooperated with Mr. Wilkinson, and have proved themselves capable and efficient assistants. Few engineers have had more experience than these three in road building.

El Caney road:	
Total allotment to December 31, 1900	$29,000.00
Total expenditure to December 31, 1900	24,046.64
Balance to credit of disbursing officer	4,953.36

The above expense includes $5.79 paid for customs duties and $1,358.62 for transportation.

In July, road from Caney to stone bridge across the San Juan River was completed, necessitating the quarrying of 1,089 cubic yards rock and the laying of same on road.

Total expense this section for period		$3,678.38
Length of section completed during period	linear feet..	2,940
Total square yards in section		4,900
Cost, 4,900 square yards, at 75 cents		$3,678.38
Total cost of road		$15,208.74
Total length of road	linear feet..	9,960
Total square yards in road		16,150
Cost, 16,150 square yards, at 94 cents		$15,208.74

This section was put in as light as metalled road could be put in to be useful. It was thoroughly drained, but owing to impracticability of taking steam roller off San Luis road only a horse roller was used. The road has stood well except the 300 yards to east of San Juan bridge. This was under water in the September rains and only the foundation stone remains. It will have to be raised and rebuilt.

On the 1st of September the road was started from the city of Santiago, and the end of November found it practically completed for 3,500 feet, to near its intersection with the San Juan road. At this point it was considered desirable to stop the work till the appropriation had reached a sum sufficiently large to do work to best advantage. I submit complete report of work and inclose plan, profile, and details. I call special attention to sanitary work done in connection with the road, and which increased its cost 50 per cent. The work on El Caney road was begun on September 1, 1900; during which month there was an unusually heavy rainfall, which, owing to the nature of the soil, retarded the work considerably. The subsoil along the whole line of the work is very heavy clay, containing a large percentage of lime, which when dry is extremely hard, but which requires very little moisture to make a very tenacious mud, very difficult to handle. Formerly the road was impassable after heavy rains for all vehicles.

Specifications for road were as follows:

Adjacent to city of Santiago, for a distance of 2,000 feet, road to be graded 41 feet in width with 24 feet broken stone as shown on cross sections of attached plan. For remaining distance, to be 31 feet in width with 16 feet of broken stone. Broken stone to have a thickness of 10 inches in center and 8 inches at side; foundation to be 4 inches thick throughout its width, no stone to have greater dimensions than 4½ inches; next course of stone to have a thickness of 4 inches at sides and 6 inches at center, to to be composed of stone passing 1½-inch ring; binder to be composed of quarry chips, sand clay, and disintegrated coral rock found on sides of road, to be washed into road and rolled till the surface is thoroughly compact and smooth. Surface of finished road to have slope from center each way of 1 in 16, surface of wings to be flush with sides of road and have slope to ditch of 1 in 8. Subgrade to be thoroughly compacted by steam roller and filled till it stands up to cross section, and each course of stone to be thoroughly rolled and compacted by steam roller. Wings to be compacted as subgrade.

At the beginning of the road, where the city is thickly built up, it was found necessary to pave the gutters and build a small retaining wall to prevent the fill from being washed out by the large amount of water carried in the gutters.

In all places where the soil contained much vegetable matter or was in other respects unsuitable for the subgrade, it was removed and its place filled with dry earth.

Wherever the wings were firm enough to retain the macadam, the cordon or curb of large stone was omitted. Wherever it was necessary to fill in the wings, the dirt was thoroughly rammed by hand in 2-inch layers, and, after the stone was in position, was also thoroughly compacted by rolling with the steam roller.

The item of drainage was very large, but the conditions were such as to require it.

In building the first culvert we were enabled, by deepening the existing ditch and extending it to the north, to intercept a large amount of water which previously ran down the roadway to the first lagoon. The culvert also takes all the water from the first 1,000 feet of road, draining in all about 80 acres of watershed. The second cul-

Digitized by Google

vert was built to drain the first lagoon, replacing an old Spanish culvert in very poor condition which was not low enough to completely drain the lagoon. The lagoon had received the sewage from the civil hospital and the Spanish barracks for several years, and that, with the decaying vegetable matter, combined to make a very unhealthy spot. Nearly every man engaged in working on the ditching or on the culvert was taken sick with the malarial fever. At present, however, the swamp is thoroughly ditched, and is rapidly drying out. The second lagoon did not present such insanitary conditions as the other, as it received no sewage and during the winter months was often dry. Still there was considerable decaying vegetable matter and many of the laborers contracted malaria from working in it. The draining of these two swamps will add considerably to the sanitary condition of the outskirts of the city.

The old culvert No. 3, which was filled up by the Spaniards during the ten years' war and was reopened, is in good condition, and so situated as to completely drain the second lagoon. The only work necessary was to place a guard rail, put in a new concrete floor, and repair the wing walls.

The construction has been attended with many difficulties, which have made the cost of some items greater than they would have been if the conditions had been nearer the average. The stone was obtained from the Dos Bocas quarry, costing $5 per car hauled, or 42 cents per cubic yard; then hauled in Cuban carts to the road at a cost of 70 cents per cubic yard, making total cost of stone delivered on the work amount to $2.66 per cubic yard. That the excavation for drainage is very high is owing to two causes: First. In the excavation for the ditch and for the second culvert there were so many springs that it was almost impossible to get a solid foundation, the mud having to be cleaned out time after time. After every rain the silt had to be cleaned out of the excavation. The mud which was stirred up in the work on the culvert was deposited in the ditch below, necessitating constant cleaning to keep the water from backing up. In ditching the swamp the men had to work in mud and water from 2 to 3 feet deep. Second. In the ditch south of culvert No. 1 we encountered a ledge of hard coral rock, of which about 6 inches had to be excavated for a distance of 85 feet. It all had to be gotten out by means of picks, as, from the nature of the rock, bars could not be used advantageously, nor could we use explosives, owing to the proximity of several houses.

The amount of work done and cost is as follows:

Macadam:			
Labor		$2,188.73	
Supplies		211.53	
Stone		4,020.80	
Transportation		2,319.42	
General expenses		1,539.47	
8,212 square yards, at $1.252			$10,280.00
Grading:			
Labor and transportation		4,608.46	
Supplies		41.42	
General expenses		818.64	
5,567 cubic yards, at $0.982			5,468.52
[NOTE.—This cost includes the dressing to finished grade, ditching, and the final trimming.]			
Curb and gutter:			
Labor and transportation		465.52	
Stone		78.90	
Supplies		13.20	
General expenses		57.88	
			615.50
700 linear feet curb, at $0.308	$215.44		
166 square yards gutter, at $2.41	400.06		
Retaining wall:			
Labor and transportation		420.84	
Material		139.94	
General expenses		63.52	
45.8 cubic yards, at $13.63			624.30
[NOTE.—Dry rubble, quarry faced. Foundation and top course laid in cement mortar. The stone broke with neither beds nor faces, and in the necessary dressing much time was consumed and many stones were rendered useless for anything but macadam.]			
Excavation:			
Labor		1,421.21	
General expenses		250.21	
1,450.3 cubic yards, at $1.158		1,671.42	

Digitized by Google

Masonry:		
Labor and transportation	$712.20	
Material	595.88	
General expenses	292.61	
73.99 cubic yards concrete, at $13.41 45.3 cubic yards rubble, at $13.43	1,600.69	
[NOTE.—This price includes the cost of the iron pipe, railings, and cement finish.]		
Total—Masonry	1,600.69	
Excavation	1,671.42	
		$3,272.11
Maintenance:		
Labor and transportation	117.80	
General	19.30	
		137.10
Total		20,397.53

The costs of the 41-foot and 33-foot roads, respectively, are as follows:

41-foot road—2,000 feet:		
Macadam	$6,804.30	
Grading	3,615.50	
Curb and gutter	615.50	
Retaining wall	624.80	
		$11,708.08
Cost per linear foot	$5.85	
Cost per square yard finished roadway	1.28	
[NOTE.—The excavation on the 41-foot road averages 1,863 cubic yards per linear foot.]		
33-foot road—1,500 feet:		
Macadam	3,475.70	
Grading	1,809.59	
		5,285.29
Cost per linear foot	$3.52	
Cost per square yard finished roadway	.96	
[NOTE.—The excavation on the 33-feet road averages 1.22 cubic yards per linear foot.]		
Drainage	3,272.11	
Maintenance	137.10	
		3,409.21
		20,397.53
Road repairs:		
Total allotment allowed to December 31, 1900		8,325.28
Total expenditures to December 31, 1900		2,566.50
Balance to credit of disbursing officer		5,758.78

The above allotment includes $3,320 allowed for the purchase of a 10-ton Russell steam roller, including freight and duty, which is required in repairing roads already completed, as it is impracticable to bring either of the rollers now working on the San Luis road, owing to distance of work. Work done consisted in making San Antonio road passable for a mile and a half from city, practically rebuilding road. Morro road was repaired owing to washout by September storm and finished so as to be passable, requiring 1 mile of road to be rebuilt. Las Cruces road was repaired where gutters and macadam had been washed out. No work done in December.

Cobre road and trails:	
Approved project	$10,000.00
Total allotment allowed to December 31, 1900	500.00
Total expenditures to December 31, 1900	700.48
Deficit	200.48

These trails were started under imperative and rush orders to build the trails at once so as to be available for taking out coffee before the spring rains. No work under way could be dropped or men spared to go to Cobre, look over the ground, and draw up specifications. Proposals were invited from several who it was thought could do the work, resulting in receipt of one proposal to build 10 miles at average cost of $1,100 per mile. Owing to inability to get data as to whether this was a good proposition or not, I made verbal agreement with Mr. Golden, who had done considerable work for me on road repairs and in whom I had great confidence, to organize the force, take his own teams, tools, and tentage, go to Cobre and start the work and push it as rapidly as possible till I could estimate its proper cost, for 15 per cent of the expenses. I consulted the municipal council of Cobre and General Cebreco and decided to build the trail from Cobre to Dos Palmas and thence to Cauto River. Specifications required a roadway 8 feet wide, thoroughly drained, and passable for one cart. My confidence in Mr. Golden was not misplaced; his ability not to do work where it was not needed proved as good as doing it where needed, and, to use his own term, he is "going like a house afire," building at the

Digitized by Google

rate of a mile in six days, and as good work as if it had been planned and laid out with an instrument. The work will be finished to the Cauto by end of February.

Nispero wharf:	
Total amount of contract authorized	$19,605.00
Amount allowed in December for double and single bracing and splicing and reimbursement customs dues	307.78
Total expenditures to date, including all dues	19,910.93
Balance to credit of disbursing officer	1.85

Of the above expenditures, $150.13 was amount refunded to Mr. Porro for duty paid by him on material, which at time of making contract was admitted free of duty. Below is report of Lieutenant Hamilton on this work:

Wharf in Nispero Bay: The plans for improvement of Morro Castle involved the idea of a wharf as near as possible where government freight might be landed directly from government transports. The preliminary surveys made by this department in December of last year showed the practicability of building a small wharf in Nispero Bay, alongside of which any transport entering Santiago Harbor might lie and discharge her cargo. This wharf was to connect with government warehouses and then by a good road to Morro Castle and Santiago. The entrance to Nispero Bay is just to the eastward of the *Merrimac*, and will involve the destruction of a portion of that vessel. This, however, will not be a difficult undertaking. The practicability of using this bay for the purpose named is proven by the fact that it was in this same bay that a portion of Cervera's fleet sought shelter at different times during the period when the fleet was shut up in the harbor of Santiago. Plans have been prepared and a contract made by this department for the construction of a suitable wharf. Contract price, $19,605. The main wharf is to be 250 feet in length by 30 feet in width and connected with the shore by an ell 270 feet long by 16 feet wide. There will be a minimum depth of 22 feet of water along the outer edge of the main wharf when constructed. Work has been begun on the wharf and it will probably be completed by the end of July. The wharf will be 10,650 feet from Morro Castle and 6 miles from Santiago. Amount paid on wharf to present date, $6,161.48.

It will be noticed that the estimate of time was erroneous, and I seriously question whether the practicability of the bay for Cervera's fleet demonstrates anything about a transport, and I urge that steps be taken to place buoys so that responsibility for grounding in the bay can be fixed, and that the *Merrimac* be removed. The construction of the wharf was completed September 26, 1900. It was at all times under supervision of engineer employed by me, and final inspection showed it to be built according to plans and specifications and in a workmanlike manner, and it was accepted October 4, 1900, and final payment made. It is to be observed that this office has had charge of work costing $213,778.14 in the six months. This work has all been done by day labor, plans, specifications, everything drawn up here, without any outside assistance; in addition, it has supervised its one piece of contract work, Nispero wharf. The difficulties that had to be overcome are too many to detail. At Guantanamo, with, I am confident now, little idea of what it meant, it was decided to put in a cut stone ogee dam. The men had to be trained, trained from a dollar a day man to a stone cutter at $3, when they left for the cities. After training them they could be counted on to do only one quarter the work of an American stonecutter. It was due solely to Mr. C. A. Knowlton, resident engineer in charge, that the dam has been completed. Possessing all the practical knowledge of the master stone mason and the theory and practice of the hydraulic engineer, he has pushed to completion the work in good shape. A number of photographs and plans are inclosed with a view of illustrating the work.

Little or no supervision was exercised by me over engineer officers throughout the department (ended November 15, 1900), owing to most of their instructions coming direct and their reports consequently, with few exceptions, going direct.

Reports on harbors, conditions of roads and trails, location of towns, and general existing conditions were received as follows: First Lieut. T. A. Pearce, Fifth United States Infantry, Daiquiri, Siboney, Aguadores, Cubanas Bay, Canizo River; First Lieut. H. E. Knight, Fifth United States Infantry, Baracoa, Duaba, Naguanje or Naguaraje, and Nibujon; Second Lieut. J. W. Wright, Fifth United States Infantry, Baracoa, Yacabo, Boca de Tanamo, Mata and Guandao, Boca and Sagua de Tanamo; Maj. C. A. Stedman, Tenth United States Cavalry, Manzanillo and San Salvador; First Lieut. H. A. Smith, Fifth United States Infantry, Guantanamo, Baitiquiri, Jaruco, and Yateras River; Capt. William F. Flynn, Eighth United States Cavalry, Puerto Principe, Vista Hermosa, Rio Najasa, Guayabal, El Junco; First Lieut. G. W. Kirkpatrick, Eighth United States Cavalry, Puerto Principe, Vista Hermosa, Ecuador, Rio Rapido, Rios Contramaestre, Blanco, Carasco, and Najasa; Capt. R. J. Duff, Eighth United States Cavalry, La Gloria, La Guanaja, Morón, Ciego, La En-

Digitized by Google

trada, San Geronimo, and Puerto Principe; First Lieut. W. G. Sills, Eighth United States Cavalry, Santa Cecilia, Santa Cruz del Sur, Vertientes, Rios San Pedro, Trinidad, and Altamira; Squad Sergt. Maj. Oscar Dersner, Eighth United States Cavalry, San Fernando, Isla de Turinguano, Punta Alegre and San Juan, Moron, Chambas and Arroyo Blanco, Marroquio, Tamarindo, and Guadalupe; First Lieut. J. M. Morgan, Eighth United States Cavalry, Nuevitas; Capt. A. G. Hammond, Eighth United States Cavalry, Rio Lazaro, Rio Caymao, Magarabomba, Ciego de Avila.

Owing to no provision of funds or force to combine and complete these reports, nothing was done except to index them. On the 26th of December they were forwarded to the adjutant-general district of Santiago, as pertaining to the old Department of Eastern Cuba.

Very respectfully,

S. D. ROCKENBACH,
First Lieutenant, Tenth United States Cavalry,
Engineer Officer.

CHIEF ENGINEER, DEPARTMENT OF CUBA,
Habana, Cuba.

Return of employees on engineer force for the month of December, 1900.

Trade or occupation.	Time of piece of work.	Monthly wages.	Amount.
1 principal assistant engineer	1 month	$250.00	$250.00
1 resident engineer	do	190.00	190.00
Do	do	140.00	140.00
1 chief clerk	do	133.33	133.33
1 bookkeeper	do	100.00	100.00
1 property clerk	do	115.00	115.00
1 pay clerk	do	80.00	80.00
1 interpreter	do	75.00	75.00
1 storekeeper	do	80.00	80.00
1 messenger and janitor	do	45.00	45.00
1 surveyor	do	100.00	100.00
1 resident engineer	22 days	115.00	84.33
Total			1,392.66

ORGANIZATION AND REGULATIONS FOR THE ENGINEER DEPARTMENT OF EASTERN CUBA.

AUGUST 31, 1900.

The force will consist of the engineer officer, principal assistant engineer, and such number of resident engineers as may be necessary, and an office engineer.

The engineer officer will perform the duties of chief engineer, will be in immediate charge of the fiscal affairs of the department, sign and approve all requisitions, will give general instructions for all work carried on by the department, and examine and approve of all work of sufficient importance to require a plan. All communications concerning work, verbal or written, with higher authority or persons not connected with the department, will be carried on by the engineer officer.

The principal assistant engineer will perform the duties of consulting engineer, be in immediate charge of all work carried on by the department in the city of Santiago, and supervise all detached work. He will be in charge of the office engineer and draftsmen, and the preparation of plans and estimates, the filing of same, and of engineering records. In the absence of the engineer officer, he will perform the engineering duties of that officer and will be obeyed and respected accordingly.

S. D. ROCKENBACH,
First Lieutenant, Tenth U. S. Cavalry, Engineer Officer.

[Circular letter No. 1.]

ENGINEER DEPARTMENT,
Santiago de Cuba, ———, 1900.

To ——— ———:

[Subject: Timekeeping.]

The following plan for the keeping of time on all works of the engineering department will be strictly followed from and after September 1, 1900:

Each section of work will be provided with a general timekeeper, who must take the individual time of his entire section at least twice each day. He will be provided

Digitized by Google

with two time books, one to be used each alternate day and turned into the office of the resident engineer on the evening of the day for which it is used, at which time he shall receive his book for the following day. His name and the words "General time" shall be plainly marked on the back of his books.

Each capataz shall be provided with a similar set of time books with his name indorsed thereon, in which he shall enter the time of his men at least four times each day. These time books shall be collected and delivered to the office of the resident engineer each evening and the books for the following day distributed.

All time books shall state the number of employee's identification check, his name, occupation, the hours worked, and the rate of wage.

At the beginning of a man's employment the general timekeeper shall give him one of the identification checks provided for that purpose, entering the number thereof opposite his name on the general book; and he will give said number to the capataz. The employee will retain his check during the entire time of his employment. Should one of these checks become lost, the employee must notify the timekeeper at once, so that a record can be kept, and the man will be given a new check.

In the office of the resident engineer a journal of time will be kept in the book provided for that purpose by the engineer department. This book must be posted each day from the general time book for the day preceding, and then checked against the capataz's book for the same day. Any discrepancies found must be at once investigated and rectified, and proper steps taken to prevent a recurrence.

All pay rolls will be made in the office of the resident engineer and will be certified to by him before being sent in to the engineer officer. They will be so kept that on the day following the two weeks' end they shall be completed and shall be sent to the engineer office not later than the second day following.

All employees of the engineer department directly employed on any section of work shall be carried on the rolls of that section.

Respectfully,

S. D. ROCKENBACH,
Engineer Officer.

[Circular letter No. 2.]

HEADQUARTERS DEPARTMENT OF EASTERN CUBA,
CHIEF ENGINEER'S OFFICE,
Santiago de Cuba, August 31, 1900.

Resident engineers will be in immediate charge of the work assigned to them, and will have under them such number of instrument men, draftsmen, clerks, timekeepers, foremen, mechanics, and laborers as may be necessary, as approved by the engineer officer, and shall have power to suspend or discharge employees for sufficient cause. The power of removal should be exercised discreetly and, except in case of laborers, seldom without reference to the engineer officer. They will prepare and submit, through the principal assistant engineer, to the engineer officer plans and estimates for all structures requiring a plan, and, through the same channel, report for approval and deviation that they may deem necessary from the general directions and standard plans and sections furnished them. They will receipt for and be charged with all tools, machinery, and material used by the force under them; will furnish the following report: On the 11th, 21st, and 1st of each month a report of operations; on the 1st of each month a return of employees and report of property, all on forms furnished. They will have prepared and submit direct to the engineer officer, each two weeks, pay rolls of their force in triplicate. They will have under them directly and absolutely a timekeeper who will check time of foremen and assist clerk in preparation of pay roll. They will give careful attention to preventing fraud in payments, and their O. K. of pay roll will be a certificate on honor that the rolls are correct. They will be held responsible for the sanitary condition of the camps of their force.

All official communications, verbal or written, shall pass from the superior to his immediate subordinate, or from the subordinate to his immediate superior. Should any emergency necessitate a deviation from this rule, the party immediately concerned should be informed of it.

S. D. ROCKENBACH,
First Lieutenant, Tenth United States Cavalry, Acting Engineer Officer.

Digitized by Google

[Circular letter No. 3.]

HEADQUARTERS DEPARTMENT OF EASTERN CUBA,
CHIEF ENGINEER'S OFFICE,
Santiago de Cuba, September 3, 1900.

[Subject: General instruction.]

On and after this date all circular letters and general instructions shall, upon receipt thereof, be placed in a file to be provided for that purpose for safe-keeping and reference.

All employees receiving letters of general instruction shall, upon receipt thereof, properly instruct all subordinates who may be affected thereby.

S. D. ROCKENBACH,
Engineer Officer.

[Circular letter No. 4.]

HEADQUARTERS DEPARTMENT OF EASTERN CUBA,
CHIEF ENGINEER'S OFFICE,
Santiago de Cuba, September 3, 1900.

In order that the work of this department may not be hampered by employees leaving the service without due notice, the following rule has been adopted and will be adhered to henceforth:

All employees on a monthly rating of $100 or more shall not leave the service of the department without giving thirty days' notice.

Should this rule be violated, the party so offending shall forfeit all pay due him to the extent of thirty days' pay.

In the event of the services of such an employee being no longer required by the department he will also be given thirty days' notice, provided, however, that in the event of misconduct on the part of any employee he shall be discharged summarily.

It is not the intention of the department to hereby work any hardship or injustice on the employees, and in any extreme case a request for relief, accompanied by a statement of the reasons why the thirty days' notice can not be given, will be considered by the engineer officer, and the employee will be expected to abide by his decision.

S. B. ROCKENBACH,
Engineer Officer.

[Circular letter No. 5.]

HEADQUARTERS DEPARTMENT OF EASTERN CUBA,
OFFICE OF THE ENGINEER OFFICER,
Santiago de Cuba, September 18, 1900.

[El Caney pay rolls.]

All rolls must be in this office on the Monday morning following the Saturday which the roll includes. Caney roll will be paid every Thursday following the Saturday which the roll includes at 11 a. m. at the camp of the resident engineer. All men must be present for payment, and no men except those sick or who are discharged will be paid by the disbursing officer in the city of Santiago. The identification check of these men will be marked "sick" or "discharged." Men who neglect to come to payment will not be paid till the next regular payment. Engineer, assistants, timekeepers, and foremen will be charged with having all men present and enforcement of this circular.

S. D. ROCKENBACH,
First Lieutenant, Tenth U. S. Cavalry, Acting Engineer Officer.

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

Digitized by Google

Barricades and lights: The contractor must erect all necessary barricades and furnish necessary red lights to protect the public from injury, and will be held responsible for any damage that may result from his failure to do so, or from his failure to take any other precautions necessary to protect the public from injury by reason of the doing of the work.

Refuse material: Any old or unused material, obstructions, rubbish, or filth that may be encountered must be removed by the contractor at his own expense.

Workmen: Properly skilled workmen shall be employed on the work and the contractor shall dismiss any employee who in the opinion of the engineer may be considered guilty of misconduct, neglect of his duties, or who may perform his work in an improper manner.

GRADING.

Grading excavation: The street will be excavated to proper subgrade as shown on profile and cross sections and as staked by the engineer, and must be thoroughly compacted by rolling with a steam roller weighing not less than 120 pounds per linear inch of bearing surface. Any spongy places that may be developed must be dug out and filled with firm earth or broken stone and sand as the engineer may decide. The subgrade will be so formed for rolling that the space for gutter and curbing will be rolled equally with subgrade of roadway, the additional excavation necessary for gutter and curbing being made after rolling.

Embankment: Embankments must be constructed in layers not exceeding 18 inches in thickness, each layer being thoroughly rolled. The space for gutters and curbing must be rolled with the subgrade and excavation for the additional depth necessary will be made after rolling. Excavation being in excess embankment will not be paid for. All grading must be completed by the 1st of April, 1901.

CURBING AND GUTTERS.

Curbing: Curbs of Portland cement concrete of the cross section shown on drawing will be constructed to the lines and levels given by the engineer. Stone used for curb concrete must be broken to pass through a ring 1 inch in diameter and must be rejected by a screen of ½-inch mesh.

The "facing" will be composed of one part of cement to two parts sand and must be grouted into the forms as soon as the concrete has set sufficiently to allow the facing plank to be removed. As soon as the facing has set sufficiently to be troweled the form will be removed and the facing given a hard troweled finish. As soon as a section of curb is finished it must be protected from sun, rain or other damage, and must be kept continually moist until permission is given by the engineer to discontinue.

Gutters: Gutters of vitrified paving bricks laid on edge on a foundation of 4 inches of concrete and a cushion of 1 inch of sand will be constructed according to drawings and the engineer's instructions. Excepting valley gutters across street intersections the gutters will have a width of two bricks and two and one-half bricks for each alternate two courses.

Samples of the bricks proposed to be used must be submitted with each bid and must be properly labeled to identify them. Bricks not up to the samples will be rejected.

Bricks will be laid in courses perpendicular to the line of curb with ½-inch joints, which will be solidly filled with cement grout composed of one part Portland cement to two parts sand. Before grouting joints bricks will be well rammed in place and must be true to line and level. No broken bricks will be used except to close a course, and then the closing must be made with a single piece cut to fit.

Valley gutters: Where valley gutters cross street intersections the bricks will be laid in courses parallel to the line of said gutter, and the gutters will have a width of eleven courses of bricks.

FOUNDATIONS.

Curbs and concrete foundation for gutters will be constructed at one time, as a monolith, in accordance with drawings. Upon completion of the curb the foundation for asphalt pavement will be constructed, making a proper bond with gutter foundation and forming a channel in which the brick gutters will be laid. The pocket formed in the concrete foundation for asphalt where the gutter is only two bricks wide will be filled to the proper level with grout at the time the joints of the bricks are grouted.

Digitized by Google

ASPHALT PAVEMENT.

All asphalt used shall be Trinidad Lake, Alcatraz, or Bermudez asphalt, and shall not be mixed or adulterated in any manner with the products of coal tar or with any inferior bituminous material of any kind.

Class A. Class A pavement shall consist of 1½ inches of top and 1 inch of binder (when compressed) laid on a foundation of broken stone on the existing surface.

The existing surface shall be thoroughly swept with stiff brooms until all dirt and fine particles have been removed. Excavated or waste material shall be removed by the contractor. The surface shall then be brought to a uniform grade and cross section by filling with clean broken stone, not exceeding 2 inches in their largest dimensions. This stone shall be thoroughly compacted by rolling with a steam roller weighing not less than 120 pounds per linear inch of roller and the sprinkling of a fine binding material on the surface during rolling.

On this foundation shall be laid the "binder" course, consisting of clean broken stones, not exceeding 1 inch in their largest dimensions, thoroughly screened, and asphaltic cement, made from Trinidad Lake, Alcatraz, or Bermudez asphalt, as above specified.

The stone shall be uniformly heated and thoroughly mixed by machinery with the asphaltic cement, in the proportion of about 15 gallons cement to a cubic yard of stone.

The binder shall be immediately hauled to the work and spread on the foundation with hot iron rakes and rammed and rolled while hot and in a plastic condition until it has a thicksess of 1 inch. The surface of this course shall be exactly parallel to the surface of the top course to be laid; upon this course shall be laid the top course or pavement proper. It shall be composed of such proportion of asphaltic cement, clean silicious sand, and pulverized carbonate of lime as will make the pavement homogeneous. The contractor will be allowed to use his own judgment in regard to fixing the above proportions, and will be required to maintain said pavement in good order and repair for a term of five years as provided for in contract.

The sand and asphaltic cement shall be heated separately to about 300° F. The carbonate of lime, while cold, shall be mixed with the hot sand in the required proportions, and then mixed with the asphaltic cement at the required temperature in a suitable apparatus which shall effect a perfect mixture.

The pavement mixture, prepared in the manner thus indicated, shall be laid on the foundation in one coat. It shall be brought to the works in carts or wagons at a temperature of about 250° F., and be properly spread, by means of hot iron rakes, in such manner and to such depth that when thoroughly compacted by ramming and rolling it will finish true to the levels given and have a depth of not less than 1½ inches at any point. The pavement shall be rolled with a steam roller weighing about 125 pounds per linear inch of roller until it ceases to make an impression on the surface. When the pavement forms a junction with an intersecting street not paved with asphalt, a stone header shall be constructed across said intersecting street, on which the asphalt shall abut. Said header shall be at least 12 inches deep, and the stones sufficiently dressed to form close joints and a true upper surface. Rough flag stones will be furnished for said headers by the city at its storehouse, but the contractor must haul, dress, and set same at the price bid.

Class B. When the subgrade has been properly graded, it shall be thoroughly rolled with a steam roller, at the weight above specified; any soft or spongy places shall be dug out and filled with firm earth, well rammed, and rolled. Upon the subgrade thus prepared shall be laid a foundation of 4 inches hydraulic cement concrete, to be made as hereinafter specified.

The surface of this concrete when laid must be parallel to the proposed surface of the finished pavement. Upon this foundation, when thoroughly set, will be laid the binder and top courses as specified for Class A.

Class C. Class C pavement will be as specified for Class B with the exception that concrete foundation will be 6 inches in thickness.

MATERIALS.

Stone: All stone used must be sound clean stone, equal in quality to the stone obtained from quarry known as Dos Bocas quarry. Stone for foundation concrete must be broken to pass through a 2½-inch ring. Stone for concrete curb and binder course must be broken to pass through a 1-inch ring and to be rejected by a ½-inch screen.

Sand: The sand used (excepting sand in asphaltic composition) must be clean beach or other approved sand, and must be stored along the work on platforms and not on the ground.

Digitized by Google

Cement: Cement used for curb and gutter work must be hydraulic Portland cement, of a brand approved by the engineer. The cement used for pavement foundation will be natural cement equal in quality to the best Black Diamond or Buffalo cements. All cement used shall be the best of its class and shall be newly manufactured and preserved dry until used.

Concrete: All concrete used shall be composed of one part of approved cement, two parts sand, and five parts broken stone, as above specified. The sand and cement must be thoroughly mixed together, the stone will then be added and the whole thoroughly mixed together with just sufficient water to bring the whole to a plastic condition, when it must be immediately placed in position and gently rammed until the water flushes to the surface. Concrete must be mixed in small batches as required for immediate use. No concrete which has partially set shall be used or remixed.

All concrete must be mixed on water-tight platforms.

Mortar: All mortar or grout used shall be mixed in proper mortar boxes and in small batches as required for immediate use.

Mortar will generally be composed of one part cement to two parts sand, but should the engineer deem it necessary these proportions may be changed, and should such change increase the cost of the work to the contractor due allowance shall be made.

Contractor to be on work: The contractor shall at all times be on the work himself or have a competent agent there, with full power, to whom directions and orders may be given.

APPENDIX G.

HEADQUARTERS POST OF MANZANILLO,
OFFICE OF DISBURSING OFFICER,
Manzanillo, Cuba, January 15, 1901.

SIR: In reply to your circular letter of December 22 last, I have the honor to inclose herewith a statement of the amounts expended in public works by this office during the six months ending December 31, 1900. As there are no records in this office showing the exact amount of work done each month, it is impossible for me to make such a report except for the month of December. The work done was as follows:

Bayamo-Baire road: Repairing bad places in the roads, such as swampy places, boggy creek crossings, by putting in small hard-wood culverts and building approaches by filling in with stone to a level about a foot above that of the surrounding country.

Bridge over slough near Sofia mill: A simple affair about 18 feet long by 15 feet wide with hand rail.

Completion of bridge commenced by people of Cano: Completion of the flooring of a trestle work over a low place in the town about 50 feet long.

Manzanillo-Bayamo road: This work consisted of repairs to and metaling of road between Manzanillo and Blanquizal. For December the work consisted of metaling 417 linear yards of road 18 feet wide, 6 inches deep, at a cost of about $1.21 per running yard of road.

Bridges over Ojo de Agua and Jibacoa rivers: The amount expended was for material and part payment of contract for bridge over Jibacoa.

Improving streets of Manzanillo: This consisted of ditching, draining, and macadamizing streets, and putting in culverts at crossings.

In December the work was repairing washes in street leading to barracks, about 300 yards of a steep hill.

Very respectfully,

L. HARDEMAN,
First Lieutenant, Tenth Cavalry, Engineer Officer.

THE ENGINEER OFFICER, DEPARTMENT OF CUBA,
Habana, Cuba.

Digitized by Google

Amount expended on public works July 1, 1900, to December 31, 1900, inclusive.

Items.	July.	August.	September.	October.	November.	December.	Total.
Bayamo-Baire road	$1,964.89	$2,181.92	$1,998.61	$2,056.45	$412.71	$1,441.50	$10,056.08
Bridge over slough near Sofia mill				243.00	158.81		401.81
Completion of bridge commenced by people of Cano				56.00	146.65		202.65
Manzanillo-Bayamo road			64.23	388.93	114.06	502.09	1,069.31
Bridge over the Ojo de Agua river						1,433.64	1,433.64
Bridge over the Jibacoa river						380.47	380.47
Advertising, etc		1.60					1.60
Drawing instruments, material, and express on same		41.78					41.78
Total	1,964.89	2,225.30	2,062.84	2,744.38	832.23	3,757.70	13,587.34
Improving streets of Manzanillo	323.50	505.47	473.06	1,243.30	162.94	102.00	2,810.27

APPENDIX H.

HEADQUARTERS DISTRICT OF HOLGUIN,
OFFICE DISTRICT ENGINEER,
Holguin, January 14, 1901.

SIR: In compliance with letter of instructions from your office dated December 26, 1900, and received January 11, 1901, I have the honor to submit the following report of operations for the six months ending December 31, 1900.

MILITARY DEPARTMENT.

Barracks and quarters.—Three troops at this post occupy old Spanish barracks, and one is in camp in floored wall tents. These barracks and the military hospital have required continual minor repairs of every description, and especially as to the roofs, which are of tiles and continually need replacing and resetting. Officers' quarters and storehouses are rented in the town at a very low rental, but many of them on condition that repairs be made by the Government, the owners not being able to make them.

Summary of work:

1 palm-thatched barracon constructed for horses of Troop B, Tenth Cavalry, with mangers and feed boxes, size 270 by 27 feet		$700
1 saddle room, Troop B		100
1 kitchen and dining room for Troop B		125
All other repairs to barracks and hospital, including construction of camp for Troop B		1,834
Material	$861.45	
Labor	972.55	
Repairs to officers' quarters and rented storehouses, compensated for by low rate of rents		365
Material	$183.00	
Labor	182.00	
Total barracks and quarters		3,124

MUNICIPALITIES.

Sanitation.—Repairs to streets, Holguin, $7,376. Upon the arrival of the American forces the streets of this town were found in a most deplorable condition, being almost impassable for carts. A considerable amount of work on minor repairs has been previously reported on and this work was continued during the past six months. During the earlier part of the work it was found necessary to employ day labor both on account of the lack of local technical skill in the direction of the work, and in order to afford employment to a large number of destitute persons. By the models so set and by the improvement in conditions these objections have about disappeared as regards this class of work, and the method of executing the same by contract has become the best wherever its continuity admits of its being covered by proper specifications.

Description of work (done July 1 to December 31, 1900). Four masonry retaining walls to the approaches to bridge over the Jigue were constructed, 3 feet thick, 50 meters long, and from ground level to 2½ meters high at bridge. The approaches were filled in and surface macadamized.

Digitized by Google

Comercio street from Parque Maceo to Plaza Garcia, 7 blocks, about 600 yards. Surface stone drains laid in mortar and cement on each side; the street was leveled, filled in and macadamized with broken stone, gravel and marl surface, and then rolled.

On three sides of Parque Cespedes the street was widened, road bed and drains constructed.

A considerable amount of work was done throughout the town in the way of minor repairs to streets, removing rocks, leveling and filling in rough portions, and altering and improving the drainage.

Repairs to Parque Cespedes, $390. Leveling, laying out walks, and planting trees, etc. This work is being done by private subscription with some municipal assistance and was aided to the above extent.

General sanitary work, Holguin and Gibara, $2,584.37. This includes cleaning of streets and habitations of the very poor, disinfecting, etc. Also scavenger work in public buildings in Holguin, where dry earth have been substituted for pit closets.

Cemetery at Las Tunas, $700. The old cemetery, 1,000 square meters, was much too small for the needs of the town, the walls were largely destroyed and the whole in bad state of repairs. The walls were restored to their original height, 2 meters, and addition was built of 1,000 square meters inclosed by masonry walls of 1 meter in height, surmounted by an iron picket fence of 1 meter in hight, supported by masonry pillars of same height every 4 meters. Ornamental gates were constructed of cedar, mahogany, and iron pickets, and the whole was thoroughly cleaned and leveled.

Slaughterhouse at Las Tunas, $775. The old slaughterhouse was almost completely destroyed, walls razed nearly to the ground. The walls of the outer inclosure, 44 by 25 meters, were rebuilt to a height of 2 meters, a tile roof, 25 by 9 meters, occupies one end, with room for storage of implements, etc., two pens of hard-wood posts and poles, and all necessary accessories of a slaughterhouse. The roofed portion is floored with brick and cement, with good slant to the front into brick drain, which is carried under the wall to the river. The well was thoroughly cleaned and repaired. The whole affords excellent sanitary conditions.

Cemetery at Puerto Padre, $117. An ornamental wire fence for this cemetery was purchased during the last fiscal year at a cost of $800. This was put up. The cemetery was cleared and leveled and a road opened.

Artesian well boring, Gibara. Permanent machinery less 5 per cent and supplies remaining on hand, $4,381.51. Total cost of boring, $2,532.87.

In compliance with telegraphic instructions from Headquarters Division of Cuba, dated March 29, 1900, I purchased the machinery on accepted bid and proceeded to bore a well. The place selected was that indicated by an expert sent down by the Bacon Air Lift Company, and had the best indication of water to be found within two miles of the city. The boring began August 8, 1900, and was continued until November 20, 1900. Numerous difficulties were encountered, such as breaking of tools and telescoping of 8-inch pipe on account of the difficulties offered by the nature of the ground. For the latter reason the first hole had to be abandoned after reaching a depth of about 212 feet. A new hole was opened and at 75 feet and 90 feet fresh water was encountered but in such small quantities as to be valueless. From this depth on there was an alternation of rock strata and sand bearing large quantities of salt water. At 560 feet a considerable salt water bearing stratum was encountered, and it being impossible to shut this off no further depth could be attained. In this well 8-inch and 6-inch pipe were used, it being necessary to change to 6 inches at 146 inches on account of telescoping. While it is believed that by employing 10, 8, and 6 inch pipe a further depth could be reached, the prospect of obtaining water at this point or any other within two miles of Gibara is extremely slight. Beyond this distance it will be more advantageous to obtain the water from a river which will give an abundance of apparently good water at a distance of three miles from the city.

The town of Gibara is supplied with water from cisterns and the supply is at all times inadequate and in dry weather produces great privation, the poorer class being compelled to purchase water by the gallon.

Construction of street from Gibara to site of artesian well (on camino real Gibara to Holguín) road bed, constructed for about 1,000 yards with retaining wall on lower side, culvert, and filling, $865.

Holguin.

Holguin is supplied with water from surface wells which furnish a fairly good supply in quantity except in seasons of protracted drought, when nearly all of them go dry. The wells are located near pit closets in which the water stands in wet weather, and the strata between being a disintegrated granite there must of necessity be con-

Digitized by Google

siderable percolation. The water, moreover, is very hard, containing considerable mineral salts. An artesian well was begun above the town November 20, 1900. A considerable stream of apparently excellent water (not yet measured from lack of facilities) was encountered at 61 feet. This was shut off by 8-inch casing at 66 feet. Below this an exceedingly hard strata of sound granite was found, and on December 15, at a depth of 117 feet, all stems and bits on hand were broken, necessitating a suspension of operations until the arrival of new machinery which had been ordered from New York. It is expected to begin boring again January 15. Expense of well boring at Holguin to December 31, 1900, $635.46; material, $153.23; services, $482.23; total sanitation, $20,357.21.

Public works.

Sixteen wooden bridges on road from Puerto Padre to Tunas were finally inspected and accepted. One is 30 feet high with masonry abutments and a single span of about 50 feet. One is 18 feet high, about 75 feet long, with three spans resting on piles. These were paid for during the past fiscal year. Total cost, $5,855. A small stone and wooden bridge was built over a bad crossing of the Roble on the Puerto Padre-Tunas road, $60. Material purchased and delivered on the ground for four wooden bridges on the Tunas-Manati road, $1,516.50. These bridges are now being constructed and will prove of great advantage to the vicinity, crossing, as they do, streams almost bottomless in mud at all seasons. Total public works, $1,576.40.

General summary.

Military department, barracks and quarters	$3,124.00
Municipalities, sanitation	20,357.21
Public works, public works	1,576.40
Total expenditures in office of district engineer during the six months ending December 31, 1900	25,057.61
Of the above the following amounts were paid in January, 1901:	
Barracks and quarters	290.80
Sanitation	1,845.46
Public works	1,457.00

Very respectfully,

R. G. PAXTON,
First Lieutenant, Tenth Cavalry, District Holguin, District Engineer.

CHIEF ENGINEER, DEPARTMENT OF CUBA,
Habana, Cuba.

APPENDIX I.

OFFICE OF THE DISBURSING OFFICER,
Baracoa, Cuba, February 9, 1901.

SIR: In accordance with instructions from your office, I have the honor to submit the following report of the engineering operations at this post for the period July 1 to December 31, 1900:

Mattechin street was selected as the first point of improvement on account of it being on the direct line of communication with Guantanamo and many outlying settlements (these settlements, lying in a fruit-producing district, are almost wholly dependent upon this port as a shipping point), also on account of its almost impassable condition during the rainy season, which at times seriously threatened, if not prevented, the use of wheeled vehicles. The type of road selected is the Telford. In the laying of this road it was deemed advisable to adopt a system of central drains, owing to the fact that the buildings are, with but few exceptions, constructed without foundations. It is believed that in this way the dampness, which is only too apparent in many houses, may be greatly diminished, if not stopped entirely. Owing to the absence of a sewer system it has been necessary to so arrange the grade as to take advantage of the natural drainage. Side drains are so arranged at the intersections of certain streets as to secure an almost perfectly dry street within half an hour after a heavy rain, the water being conducted in these surface drains to the sea. Thus far a distance of about 2,100 feet has been completed, with an average width of roadway of 22 feet.

Digitized by Google

The street near the Catholic church has been widened 10 feet and a retaining wall with walk 3 feet wide placed thereon. Prior to the widening of this street carts could not pass each other.

The total disbursement for this work is $2,283.

No photographs have been attached for the reason that there is no photographer available at this place.

Very respectfully,

A. E. KENNINGTON,
Second Lieutenant, Tenth United States Cavalry.

ENGINEER OFFICER, DEPARTMENT OF CUBA,
Habana, Cuba.

APPENDIX J.

OFFICE OF THE ENGINEER OFFICER, DISTRICT OF MAYARI,
San Luis, Cuba, January 16, 1901.

SIR: In compliance with instructions from headquarters Department of Cuba, December 22, 1900, I have the honor to submit the following report of operations for the six months ending December 31, 1900, in the district of Mayari:

Expended in labor employed in cleaning and disinfecting the streets of San Luis, Palma Soriano, Dos Caminos, and Alto Songo, sanitary work, $4,772.30. Expended under public works in constructing stone pavements with gutters, and repairing roadbed of streets, $5,518.69. Expended in work on the road from San Luis to Palma Soriano, Cuba, $8,304.78. This work consisted in making the road passable, no attempt being made with the small amount of money at hand to build a thoroughly constructed work. Several wooden bridges were built over small streams which heretofore had been nearly impassable. No work is at present being done on this road as the present allotment of money is insufficient to purchase suitable machinery for road work. Expended on road San Luis to Dos Caminos, $10,012.34. This consists of about 2½ miles of as thoroughly constructed road as could be made by hand labor only. No photographs accompany this report as there was no photographer to take them. Total expended during the six months, $32,140.59.

Very respectfully,

GUY S. NORVELL,
Second Lieutenant, Eighth Cavalry, District Engineer.

CHIEF ENGINEER, DEPARTMENT OF CUBA,
Habana, Cuba.

APPENDIX K.

HABANA, CUBA, *February 26, 1901.*

SIR: In compliance with letter from headquarters Department of Cuba, December 22, 1900, I have the honor to submit the following report of the operations of the engineer department of the city of Habana for the six months ending December 31, 1900:

The office was in charge of Mr. P. D. Cunningham until July 23, and since July 24 of Lieut. W. J. Barden, Corps of Engineers.

The organization of the office includes the following divisions: (1) General office force, including offices of chief clerk and the record division; (2) pay department, (3) property department, (4) department of streets, (5) department of street cleaning and parks, (6) department of water and sewers, (7) sanitation and repair of public municipal buildings, (8) office of municipal architect.

Attention is invited to the accompanying reports of the heads of each of these divisions, which give a full report of the operations of their respective departments.

Mr. H. F. Happer has been the chief clerk of the office since the resignation of Mr. C. C. Gardner on September 30, 1900. For the sake of economy the stenographic and typewriting work of the chief engineer of the department is done in this office. The record division was under the immediate charge of Mr. C. N. Ryan till September 30, 1900, since which time Mr. F. Zimmerman has been in charge. A consolidation of the records of the subdepartments in September and their transfer to the main record office increased the work of that office, but has correspondingly relieved the subdepartments and resulted in increased efficiency in this branch of the work.

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

Digitized by Google

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

Digitized by Google

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

Digitized by Google

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

Digitized by Google

Digitized by Google

SAN LUIS ROAD, SANTIAGO.

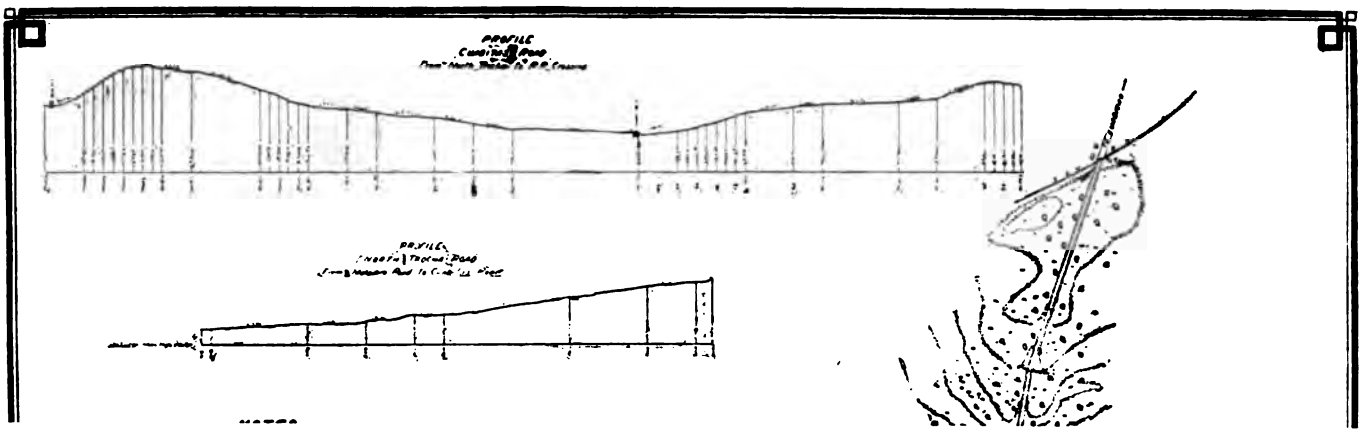
Digitized by Google

Digitized by Google

BUILDING A BRIDGE ON BONIATO ROAD, NEAR SANTIAGO.

Digitized by Google

Digitized by Google



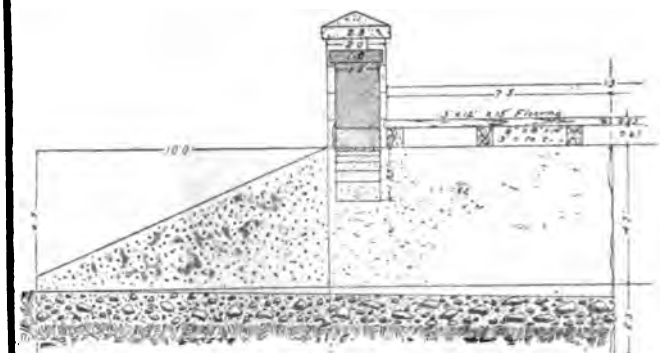
Digitized by Google

Digitized by Google

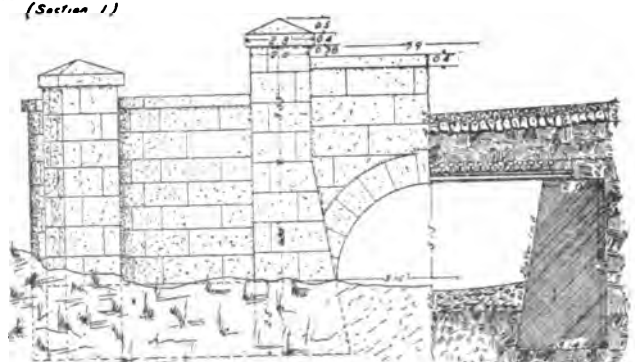
DETAILS OF CULVERTS

SANTIAGO SAN LUIS ROAD

(Section 1)



LONGITUDINAL SECTION
Culvert N° 2



END ELEVATION
Culvert N° 1

TRANSVERSE SECTION

Digitized by Google

Digitized by Google

EL CANEY ROAD.

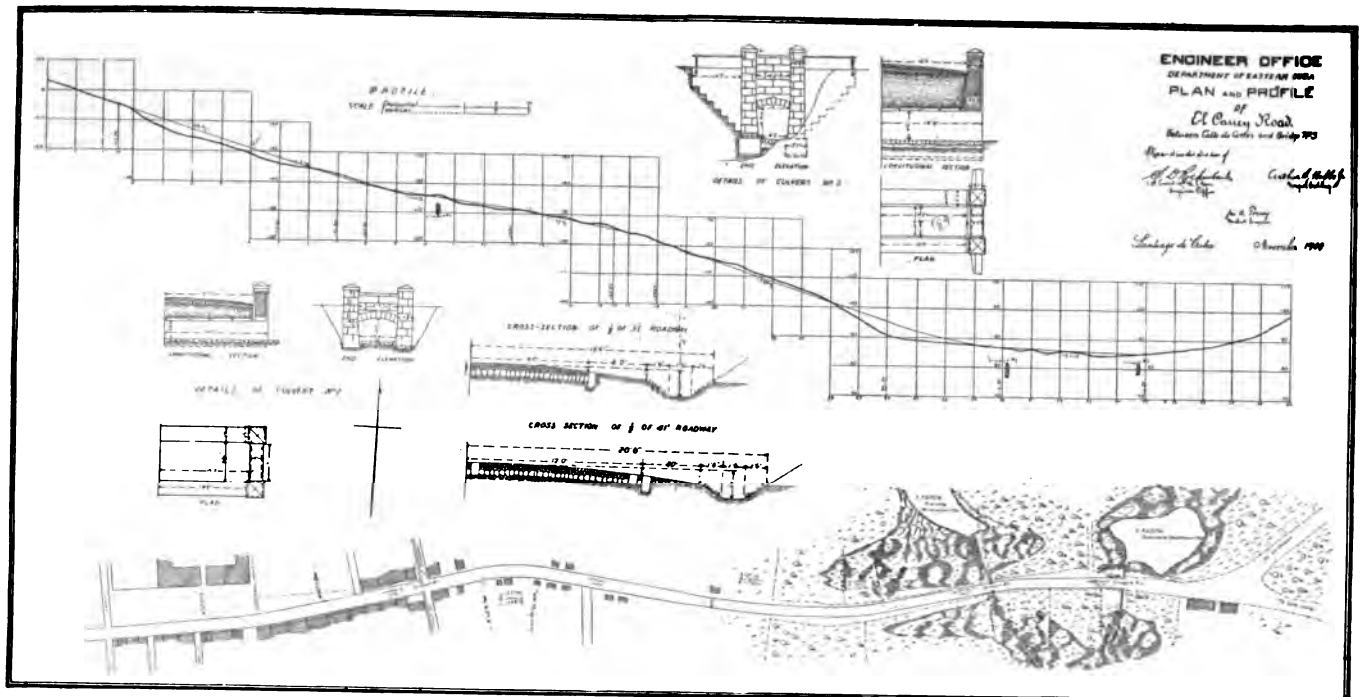
Digitized by Google

Digitized by Google

EL CANEY ROAD.

Digitized by Google

Digitized by Google



PLAN AND PROFILE OF EL CANEY ROAD.

Digitized by Google

Digitized by Google

OLD COBRE TRAIL.

Digitized by Google

Digitized by Google

COBRE TRAIL.

Digitized by Google

Digitized by Google

CHARACTER OF WORK ON COBRE TRAIL.

Digitized by Google

Digitized by Google

CULVERT ON COBRE TRAIL.

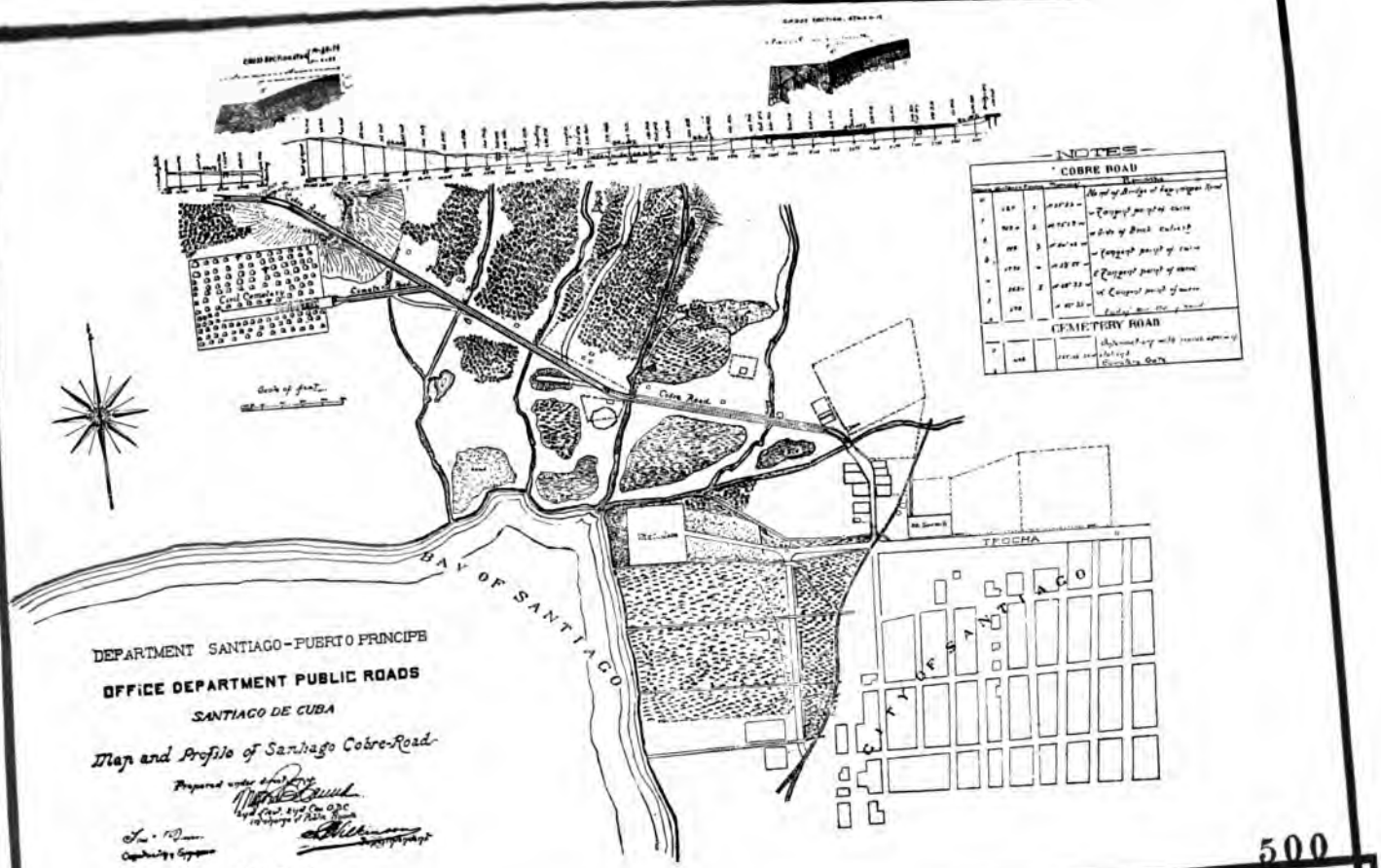
Digitized by Google

Digitized by Google

STREET IN COBRE.

Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google

BARACOA.

Digitized by Google

Digitized by Google

In a similar manner the bookkeeping formerly done under the subdepartments is now carried on by a division of bookkeeping in the office of the paymaster, Mr. W. C. Strong. This change insures uniformity, is more economical, and has proved entirely satisfactory. A change has also been made in the method of obtaining and recording liabilities, so that these are now clearly shown, and the available as well as the actual balance under any subhead is always apparent. With this exception the methods of the pay department have remained the same as previously reported. The average number of vouchers paid monthly has increased from 410 to 615, largely due to the use of new blank forms issued by the auditor of the island, which require a distinction between expenditures and purchases, and accordingly necessitate separate vouchers where formerly one sufficed. The total disbursements for the six months amount to $811,758.77. The disbursements on account of works under the immediate charge of the chief engineer of the department, amounting to $193,742.64, were also made by this department.

Attention is invited to the paymaster's statement of the two inspections of the books and accounts of his office; one, by Messrs. Haskins & Sells, certified public accountants of New York, made in compliance with instructions of the military governor, was in progress at the time of the last annual report, and was completed July 21; the other, by Maj. R. H. Rolfe, inspector-general, was dated July 22. Both reports certified as to the absolute correctness of all the accounts and expenditures.

The work in the property department, Mr. Beauregard Weber in charge, has been somewhat facilitated by the increasing familiarity of the business men and firms in Habana with the American methods of transacting business, but has been very materially increased, requiring the employment of two additional clerks, by the introduction of new forms prescribed by the auditor for the island, which require that all purchases of whatever kind be taken up on the returns and afterwards expended on special forms, instead of being expended on the purchase vouchers, as is the custom in the Engineer Department at large in the United States. The use of these forms and of those in the paymaster's office above referred to was protested against by the chief engineer of the department at the time they were first received in this office, in a letter to the adjutant-general of the department, a copy of which is submitted herewith and marked Appendix 1. During the period covered by this report two lots of condemned property of various kinds were sold, under proper authority, at public auction, for which $1,243 was received and turned into the treasury.

The financial statement of the paymaster shows that the expenses under the allotment for "administration," which includes the general office force and janitors, record department, pay department, and the property department, amount to $31,192.96, or a little more than 3 per cent of the total expenditures. In view of the immense amount of clerical work required in an office of this kind and size, the necessity of a somewhat elaborate system of purchases and payments to prevent any possibility of fraud, and the use of the cumbersome methods of accounts and property papers above referred to, it is believed that this proportion is fair and reasonable and that it can not be materially reduced. The rendition of the report called for by the Senate investigation committee, which gave in detail a full statement of "all public works of every kind, including buildings, wharves, railroads, and all other structures built or constructed, improved, repaired, or decorated by or under the authority of any civil or military officer, and in each instance the cost, value, necessity, and propriety of the same, and the uses to which said buildings or structures have been put," and "where said buildings and works were constructed or improvements were made by contract, or where the material used in the same was furnished by contract, a copy of each of said contracts, giving the names of all parties interested in each of the same, from the date of the military occupation of Cuba to April 30, 1900," required a very large amount of extra work by the regular employees of this office, in spite of the fact that special clerks were authorized and sent from Washington for that purpose.

Owing to the illness of Mr. W. N. McDonald, the superintendent of the department of streets, that department was in charge of Mr. C. C. Fitzgerald till September 25, when he resigned to accept a better position in the United States. From that date until Mr. McDonald's return, on December 15, Mr. W. H. James was in charge. During the period covered by this report the work has been chiefly that of renewal and repairs of macadam pavements and repairs and relaying of granite-block pavements. The quantity of this work has been greatly increased by that necessitated by the laying of the new tracks of the Habana Electric Railway Company. To avoid the necessity of having to relay these tracks when the new street pavements to be laid in connection with the installation of a sewerage system are placed, it became necessary to establish a comprehensive system of street grades for the city, which had never before been done, to lay the car tracks on these permanent grades, and to adjust

Digitized by Google

the adjacent pavement to the extent necessary to permit traffic. Along all of the 15 miles of track laid by the company more or less of this work was done by the street department.

All of the construction work of the company has been inspected by inspectors attached to this office. The company was obliged to pay the salaries of these inspectors, as well as the cost of changes of location of water pipes and sewers necessitated by the track construction. The new railway system is modern in all respects, and the work has been in general well done and with as little obstruction to traffic as could be expected, though a disposition has been shown by the company to do no more than was absolutely required in the latter respect. The smooth brick and block-asphalt paving between the tracks has attracted most of the traffic on streets in which tracks are laid, with the result that the wear has been very severe, particularly as the gauge of the vehicles differs from that of the tracks. This excessive wear will cease when the remaining portions of the streets are paved with similar material. The trolley poles have been located, wherever possible, in the curb, so that the obstruction to the narrow sidewalks may be reduced to a minimum without unnecessarily contracting the available width of the street. On very narrow streets trussed-pipe poles, as shown in plates, have been used.

As previously stated in reports from this office, there is no stone in the vicinity of Habana suitable for macadam pavements subject to the traffic of even the less frequented parts of Habana, and indeed no macadam pavement, however good, will stand here without frequent and expensive repairs. Arrangement has been made with the Habana Electric Railway Company to crush and deliver on the Vedado road and Infanta street the granite blocks taken up by them in relaying their tracks, and wherever the new pavements are laid there will be a large amount of similar material available which it is proposed to use in all places where brick or asphalt is not needed. It is believed that this material will make excellent macadam pavement.

Particular attention is invited to Mr. McDonald's observations on modern paving. Sufficient amounts of such pavements are in place here under such varied conditions as to give valuable data in selecting the proper class to be used in the new work. As was expected, asphalt will not stand the traffic in the warehouse districts, and in such places brick will be used. It is believed that the experiment of laying asphalt blocks on a macadam base with a thick mortar cushion has been sufficiently successful to warrant its adoption in certain cases for streets of light traffic. Cement joints for brick pavements have not proved satisfactory, for reasons stated. In grouting with pitch it has appeared advantageous to leave a comparatively heavy film over the entire pavement. When sand is properly applied this has not seemed to be slippery and apparently increases the life of the pavement.

The new tire ordinance, given on page 27 of last annual report, is to go into effect on June 30, 1901, and, if rigorously enforced, great relief will be given to present pavements and much unnecessary wear and tear saved the new ones.

The cost of the stone received from the plant at Vento has steadily decreased, until for January, 1901, it was $2.20 per cubic meter, and there is no doubt that the cost of stone purchased from private parties has been very materially reduced by the operation of this plant. To crush the granite blocks taken up when the new pavements are laid, it will probably be advantageous to move the plant to a point nearer the city.

The work of preparing a complete and accurate map of the city with corrected street grades, which has been in progress by the department for some time, is well along toward completion, practically all of the field work having been finished and more than one-half of the office work.

At the city shops, known as Los Fosos, which are under the control of the street department, all repairs to vehicles of that department and of some of the other branches of the municipal government are made, as well as repairs to steam rollers and miscellaneous work of all classes. It is essential that the department should have shops where work of this character can be done, but the buildings at present occupied are old and ill adapted to the purpose, and, moreover, the land they occupy is needed for parking. It is hoped that some more suitable location may be soon available for this purpose.

In September work of repair and renewal of the streets of Regla, a separate municipality, was begun. About 8,000 square meters of macadam have been laid with stone quarried on the edge of the town. The cost of the work has been very satisfactory, the stone being placed on the street at 96 cents per cubic meter.

Specifications for the new street pavements to be laid in connection with the sewering of the city have been prepared, grades established, and streets classified according to the kinds of paving to be laid. A map is attached showing this classification. Brick and sheet and block asphalt are the only pavements to be laid under

Digitized by Google

the ad
miles
depar
All
attach
ors, a
by th
the w
could
more
aspha
track
gauge
when
trolle
tion t
contr
poles,
As
Haba
quent
here
Haba
Infan
ever
avail
It is
Pa
Suffi
as to
was
such
bloc
sul t
for b
with
the
slipp
Th
on J
pave
Th
until
cost
the
pave
near
Th
stree
alon
mor
A
deps
brar
and
have
occu
occu
be s
Ir
cipa
ston
fact
Sp
erin
acc
cati

Digitized by Google

these specifications—the brick in the warehouse districts and wherever concentrated heavy traffic is expected and asphalt where the traffic is light. In the suburbs and where desired for pleasure driving and riding, macadam will be used, and will be laid by the city. The specifications were prepared with great care, and the requirements are similar to those demanded in the best-paved cities of the States.

The excellent work of the department of street cleaning and parks, under the superintendence of Mr. A. C. Harper, as reported in the last annual report, has been continued. The streets are all kept clean and no material change in methods or organization has been made, except that more of the sweeping is done at night. About one-third of the area in the city districts is cleaned twice daily. Besides the city proper, including Cerro, Vedado, and Jesus del Monte, the suburban villages of Ceiba, Puentes Grandes, Arroyo Apolo, Arroyo Naranjo, Casa Blanca, and Regla are included in the work of this department. A substantial reduction in the cost of this work has been made, the average number of daily employees having been reduced by 51 over that shown in the last report. The average cost of street cleaning per 1,000 square meters, including sweeping, carting, superintendence, and office expenses, was 26 cents, being less in the city districts proper and greater in the suburbs and outlying towns.

The street-sprinkling service has been improved by the purchase of three new 750-gallon sprinklers, making a total of 16 now in use. Two electrozone tanks, for distributing electrozone in small quantities for domestic and miscellaneous uses, have also been added, and the electrozone sprinklers relieved of that service. All macadamized streets of the city and the principal ones of the suburbs are sprinkled once daily and in some cases two or more times. Electrozone is sprinkled once daily on the streets of the old part of the city to the east of Cuba street, and in certain portions where the yellow fever was most prevalent.

The collection and disposal of refuse has been carried on along the same lines described in the last report. The cost of collection has been decreased from $2.16 to $1.41 per ton, a very substantial reduction, by decreasing the number of employees, without impairing the efficiency of the work. The cost of disposal by removal to sea was increased by the necessity of hiring a tugboat while the *Narciso Deulofeu*, the tug belonging to this department, was undergoing repairs, the average cost per ton for the six months being 54 cents as against 42½ cents for the previous year. The crematory has been used only to a limited extent for the purpose of disposing of dead animals and materials removed from infected houses. No coal is now used, wood and inflammable material collected from miscellaneous sources having been used instead, and the cost of cremation thereby reduced from $1.14 to 53 cents per ton.

The repairs to the tug *Deulofeu* above referred to were made at Jacksonville, Fla., satisfactory bids not having been received in Habana, during September, October, November, and December, by the Merrill-Stevens Engineering Company, under a contract approved by the military governor, and for which a special allotment of funds was made. The total amount of the work under the contract, which included overhauling, cleaning, and repairing boilers, engines, and all machinery, and certain rearrangements of pilot house and cabin to better adapt the boat to the work in which it is engaged, was $12,990. This is a good, strong, seagoing boat, and is now in first-class condition throughout.

Work on the parks, both of maintenance and new improvements, has progressed steadily and satisfactorily during this period. That these improvements are appreciated is shown by the increased number of people who use the parks for rest and recreation.

Attention is especially invited to the special works at La Fuerza, extending the sewer at the north end of Tacon street, improvement of Cortina de Valdes, construction of sea wall at La Punta, and grading and cleaning lots around portions of the old city wall, which are state works carried out by the city engineer forces under special allotments received for projects, prepared by the chief engineer of the department. The description of these projects, the methods of work, statement of progress, and cost are all given in detail in the report of Mr. Harper.

The two stables of this department, at Figuras street and at the corner of Monserrat and Colon streets, at which all of the animals and transportation of the different subdepartments of this office are kept, have been maintained in excellent condition. The cost of maintenance per animal has apparently been increased over that previously shown. This is explained by the fact that certain employees properly chargeable to this allotment were previously charged against other allotments, and that the cost of shoeing the animals, repairing harness, and certain repairs to buildings, are now included in this item.

The repair shops formerly located at the corner of Zulueta and Trocadero streets have been moved to the foot of Revillagigedo street, back of Tallapiedra wharf. All

Digitized by Google

repairs to the carts, sprinklers, and wagons of the department of street cleaning and parks are made here. The recent construction here of a number of 53-feet cart bodies for use in the collection of refuse has allowed a reduction of the number of carts used for that purpose. A detailed list of the miscellaneous work and repairs, as well as the cost of operation of the shop, is given in Mr. Harper's report.

The water and sewer department is in charge of Mr. O. Giberga. The work of the water branch of this subdepartment during the past six months has been chiefly directed toward improving rather than enlarging the system. Some 266 new services have been installed and a large number of repairs made to old, 27 new fire hydrants installed and old ones repaired, an auxiliary 4-inch valve to enable the hydrant to be cleaned or repaired without shutting off the supply of water to the adjacent district having been inserted in each case. The work of the water inspectors in detecting wastes and leaky fixtures of all kinds, the intelligent use of valves to control the flow to the lower levels, and the new mains installed and the reduction of friction in existing mains by cross connections, as reported in the last report, have combined to increase the pressure throughout the city, to give a more satisfactory service to householders, and to reduce the number of complaints of lack of water. A small number of meters have been installed, and no new installations for any large supply of water are now made without requiring a meter to be placed and the water to be paid for according to actual consumption.

The service of Vento water to Casa Blanca by means of a 6-inch flexible pipe across the harbor, a pumping station on the opposite shore, and a tank on the hill near Cabaña, described in detail on page 56 of the last report, has been maintained in satisfactory operation at a daily cost of $4.44, and the system has been extended to supply water to the new immigrant detention camp recently built near Cabaña.

The new line to Luyanó and Regla, also reported in detail in the last report, has been of great benefit to the inhabitants of these towns and to those living along the line. A number of new installations have been made at and near the former place, meters being placed at some of the larger farms and manufacturing establishments. Water was not furnished to Regla until December on account of the refusal of the alcalde to accept the conditions proposed by this office to govern the supply. As finally ordered by the governor-general, the municipality of Regla is to pay to Habana 4 cents per meter for all water received and to sell it to the people at rates to be approved by the governor-general.

The project for the improvement of the supply of Vento water to Camp Columbia, Quemados, Principe, the Pirotecnia, and military hospital No. 1, with the idea of extending it to the higher parts of Vedado and in the future to Jesus del Monte and the high parts of Cerro, which was in progress at the time of the last report, is now well along toward completion. All the pipes and connections have been laid, the boilers erected, and a contract made for an 800,000-gallon D'Auria pumping engine. The new pumping station is being built under contract with Parker, Waugh & Co., at a cost of $7,200, and will probably be finished within six weeks. It is a brick building 40 by 68 feet, classical in design, with numerous arched openings separated by pilasters, and with cornices, caps, and other trimmings of stone. It contains engine and boiler rooms and a bedroom and toilet accommodations for the engineer.

Attention is especially invited to Mr. Giberga's remarks concerning the supply of Vento water to Vedado and Carmelo. Under the terms of a concession granted to the firm of Bautista, Diaz & Co. in 1894, that company was authorized to supply and sell Vento water to the repartos of Vedado and Carmelo, taking the supply from the city main at the corner of Infanta and Principe streets. Like many other concessions granted under Spanish rule, many of the terms and conditions are indefinite and ambiguous as concerns the obligations of the concessionnaire, while the benefits to be received by him are quite clearly framed. In March, 1899, by Civil Order No. 4, office of the governor of Habana, this "alleged concession, contract, or agreement between the firm named and the city" was "abrogated and declared null and void," and the control of the system turned over to this office. The system was found to be incomplete and in bad condition, and many repairs and extensions were made thereto by this office, amounting in value to some $14,000. In August, 1900, the above order was revoked by Order No. 313, Division of Cuba, and Bautista, Diaz & Co. were "reinstated in their relations to the City of Habana in all that pertains to the Vedado and Carmelo water works." In accordance with this order and a subsequent indorsement from division headquarters, this office transferred to Bautista, Diaz & Co. the Vedado and Carmelo water system and ceased to have further control thereof. According to the terms of the concession, a certain ill-defined amount of supervision is to be exercised by the Canal de Albear over the work of the company, but, as indicated above, the conditions are so loosely drawn that it is believed that there will always be more or less trouble and conflict and that the interests of

Digitized by Google

the city can not be properly protected. It would appear self-evident that all portions of the Vedado system should rest with the city and it is believed that some means should be adopted by which the present arrangement could be terminated without injury to the just rights of the firm of Bautista, Diaz & Co.

The works at the Vento Springs, the main aqueduct, the Palatino reservoirs, and the Zanja Real have been regularly cleaned and cared for, and are now in good condition. Considerable work was done on the old Fernando VII aqueduct between Salvador and Santa Rosa streets, in removing the roots of the trees and shrubbery which had grown into the crevices of the blocks, and replacing the blocks, pointing the cracks and joints and plastering the exterior.

The matter of readjusting the water rates and preparing new rules and regulations for its supply is still under consideration, and it is hoped may be shortly completed.

The existing sewers of Habana, as explained in previous reports, were built usually for local purposes, without regard to a general plan, and of poor material, improper cross-section, with insufficient grades and lack of proper manholes. In many cases they are merely open drains, in some places covered with board sidewalks. Under these circumstances their maintenance in proper sanitary condition is a difficult and expensive work. This work during the period covered by this report has consisted of cleaning, disinfecting, and repairing the sewers, drains, and catch basins, building new catch basins where absolutely necessary, and placing new inlet gratings. In a few cases short lengths of pipe sewers have been placed to remedy serious local defects. To properly provide for the sewage from the Pirotecnia, military hospital No. 1 and the Mercedes Hospital, it became necessary to replace the 8-inch wrought iron pipe laid by the Spaniards with 9-inch and 12-inch vitrified pipe. This work was done so that it may become a part of the new sewerage system when that is installed, and includes the laying of 1,279 feet of 9-inch and 1,357 feet of 12-inch pipe, chiefly through rock excavation, and the construction of 14 brick manholes. At the end of December about 75 per cent of this work was completed.

The most important work of the sewer department has been the preparation of plans and specifications for the new sewerage system, according to the project prepared by Mr. Samuel M. Gray, as detailed in the last annual report. The securing of the necessary data for these plans and their preparation is a work of much magnitude. In addition to general details of construction, common to all parts of the system, and special details showing the special constructions of various kinds, such as tunnels, siphons, pumping stations, outfalls, etc., a working plan for each of the 3,000 or more blocks of the city is to be prepared showing all constructions now in place, such as water, sewer, and gas pipes, car tracks, conduits, depth of rock, etc., together with the correct location of sewers, drains, and manholes, both in plan and profile. For a description of the methods followed in this work, together with a statement of the progress made to date and the cost of the work, attention is invited to the report of Mr. Giberga.

As the construction of this new system, and the work of laying new pavements, all of which is to be done under one contract, is to be paid for by municipal and not insular funds—from which practically all of the work hitherto done by this office has been paid—the specifications as prepared by this office were submitted to the ayuntamiento for their approval. A number of radical changes were desired by that body, and though strenuously opposed by this office, some of them, with the approval of the military governor, have been incorporated in the specifications, so that the latter as finally prepared for advertisement differ considerably from the original draft. A full statement of the various phases of this question, which involved the settlement of the claims of Michael J. Dady & Co. in connection with an alleged contract for doing this work, is given in the report of the chief engineer of the department.

The plumbing in all new buildings and reinstallations in old ones, where ordered by the sanitary authorities, or voluntarily made by the owners, is done in accordance with specifications prepared in this office and under the direction of its inspectors. Much more of this work has been done during the past six months than at any time before since the American occupation. A set of modern plumbing regulations and proper ordinances regarding the examination and licensing of plumbers is greatly needed, and it is understood is being formulated by the sanitary board convened under Order No. 251, Headquarters Department of Cuba, December 22, 1900.

The work of cesspool cleaning and the distribution of electrozone for deodorizing and partially disinfecting sewer openings, as described in previous reports, has been continued by the subdepartment of night soil removal. Cesspools are cleaned chiefly by order of the sanitary officer, and also, to a limited extent, at the request of private parties, with the idea of preventing the exorbitant charges sometimes made by private contractors for this work. Considerable work of this class has also been done in Regla and Casa Blanca.

Digitized by Google

The electrozone plant has been kept in continuous operation, and the disinfectant produced has been used by this department in street sprinkling to a limited extent, in the disinfection of excavations in the soil in streets and houses, and in the deodorization and partial disinfection of sewer openings and outfalls, and by the sanitary department in the disinfection of floors and patios where it was not deemed necessary to use bichloride of mercury solution. The efficacy of this product as a disinfectant was investigated by Maj. Walter Reed, Medical Department, U. S. A. As much misapprehension has arisen regarding Dr. Reed's report it is appended (marked Appendix 2) here, together with the report (marked Appendix 3) of the chief engineer of the Division of Cuba, to whom it was submitted for remarks. It will be noted that Major Reed commends highly the value of electrozone of a strength of 0.250 per cent of available chlorine (146 grains to gallon) as a disinfectant and germicide, but condemns the use of weak solutions. Major Black's report corrects certain mistakes made by Dr. Reed as to the capacity of the plant and the relative cost of electrozone and of other named cheap disinfectants. After a careful examination of all of the data submitted, the military governor, himself an authority in hygiene, approved of the continned operation of the plant. The details of operation, the product and cost during the past six months, are found in the report of the water and sewer department.

The "sanitation and repair of public municipal buildings," under the charge of Mr. G. W. Armitage, has consisted mainly of small repairs to public buildings. The most important work done has been the preparation of plans and superintendence of construction of the Palatino pumping station, which has been referred to above in connection with the work of the water department, and the improvement of the Habana matadero or slaughterhouse. For the details of both of these works, and a list of the miscellaneous work accomplished, attention is invited to the report of Mr. Armitage. The work at the matadero, which has included a complete new system of plumbing and drainage, new concrete floors, and a new swine slaughterhouse, has greatly improved the sanitary conditions at that place.

The work of the municipal architect, Mr. Luis de Arozarena, is mainly of a routine nature, consisting of the inspection of all building operations, both of construction and repair, to see that they are carried out in conformity with municipal ordinances. He also has the direct charge of certain repairs and miscellaneous work done with funds furnished by the municipality. Mr. Arozarena's report shows the variety and amount of work done in his office.

On account of the volume of the work required in Habana and of its importance not only to the city and the island but also to the United States, this work has been kept under the direct control of the American officials of the military government, as stated in earlier reports. But at the same time the department is the city engineer department, ready at all times to carry out the desires of the city government in all things not directly opposed to the policy of the military government carrying into execution the city laws for municipal works, and doing all works ordered by the city government for which that government provides the funds. At any time when ordered the entire department can be transferred to the control of the municipal authorities with its personnel, records, and property, without change except substitution of one man as chief engineer of the city in place of the officer of the Army now detailed to that position. At present the operations of the department are almost entirely paid for from island funds, as the city has no revenue adequate to the work required.

In this connection, however, it should be noted that the laws and regulations at present in force governing municipal works of all kinds, particularly with reference to contracts, and the carrying out of projects of considerable magnitude, are antiquated, cumbersome, and inadequate for the proper conduct of such works. This fact has been made especially apparent in connection with the proposed contract for sewering and paving the city, the governor general having finally directed that these laws be suspended for that work, and that it be carried out as far as possible in accordance with the rules for the conduct of public works as published in Order 220, May 28, 1900.

My thanks are due and are cordially given to all employees of the office and especially to the heads of the different departments, Messrs. Happer, Strong, Weber, McDonald, Harper, Giberga, Armitage, and Arozarena, for the skill, industry, and fidelity with which they have discharged their many and varied duties.

Respectfully submitted.

W. J. BARDEN,
First Lieutenant, Corps of Engineers, U. S. A.,
Chief Engineer, City of Habana.

ADJUTANT-GENERAL, DEPARTMENT OF CUBA.
(Through Chief Engineer of the Department.)

Digitized by Google

APPENDIX 1.

HABANA, *September 4, 1900.*

SIR: I have the honor to report that there has been received in this office by the official paymaster of the engineer department an uncertified typewritten copy of a letter marked "Office auditor for the island of Cuba, Habana, Cuba, August 25, 1900, Circular No. 9," addressed "To disbursing officers" and with the typewritten signature "E. C. Brooks, First Lieutenant, Sixth Cavalry, auditor for the island of Cuba," transmitting a list of blank forms issued by his office and directing their use "to the exclusion of the old forms."

There is nothing in the circular to show that it is official, nor is there anything in any instructions which have been furnished to disbursing officers to show that the auditor has any authority to issue instructions concerning property returns. It is presumed, however, that the circular is official, and that the auditor possesses the requisite authority. That such authority should have been granted him is strange, since it is not in accordance with the United States law, nor with the Army Regulations. In both law and regulations the care of property and the regulations of the forms for its disposal are left to the secretaries of the various departments to which the property pertains. In the cases of quartermaster's and ordnance property this charge is placed by the Revised Statutes in the hands of the Quartermaster-General and Chief of Ordnance, respectively, who account to the Secretary of War.

In practice in the United States, under the authority of the Secretary of War, all returns of property of the Engineer Department are made to the Chief of Engineers and are finally acted on by him.

This too is a logical practice. The auditor can not be supposed to be sufficiently familiar with the circumstances attending the various works for which property is purchased or acquired, to know what property or how much property is needed for each, nor how such property must be disposed of.

The military governor, in Orders Nos. 220 and 249, current series, has promulgated regulations for the care of public property and for making returns for the same. The forms of vouchers now issued by the auditor do not permit the property expendable and expended to be dropped on the vouchers, as contemplated by paragraph 98 of Order No. 220. The former voucher arranged for this has, by the authority of the governor, been in use by the military disbursing officers having charge of public works, and it should not be changed without weighty reasons.

The instructions on the back of the forms of vouchers prescribe that the accounts shall be forwarded to the auditor, in violation of paragraph 10, Order No. 249.

The new forms require all articles purchased to be taken up and expended on abstracts which are to be rendered quarterly. These abstracts are to be made in duplicate and one sent to the auditor. All property is to be classified alphabetically under two headings, "Unexpendable" and "Expendable;" and, further, articles purchased and not paid for are to be taken up on the abstracts. This is a paper-perfect system, but is expensive and gives no adequate protection to the Government. A knave will generally have his papers perfect, and I know of no frauds which have been discovered by an auditor in a regularly prescribed audit. In the Neely case the frauds were discovered by an inspector, whose work was not provided for in the rules under which the perpetrator supposed he was working. In the Carter case the fraud was also discovered by an inspection, the papers being perfect.

Some idea of the volume of work which the new forms will cause in this office alone may be gathered from the fact that in the month of July 2,061 items of articles were purchased, of which 599 were unexpendable, which last were classified under 120 heads. At the rate of 2,000 per month, which is a fair average, this would require 6,000 items to be separated, classified, and written in duplicate each quarter. The cost can not be less than $3,000 per year, in addition to the trouble caused by the usual errors and consequent return of papers.

Will anything be gained? The expendable articles are mainly materials of construction. Before a work is begun, a project is submitted, with an itemized statement of cost. These contain unit prices, and the governor knows before approving the project whether the cost is fair. If the work is done within the price, no great fraud is possible, and the Government is protected. If a cart is to be built, and the cart is delivered at or within the amount allotted, which has already been compared with the market rate, it certainly can afford no additional protection to the Government to have a detailed statement on Abstract D, Form 13, of the articles which were used in the construction, in addition to the list given in the voucher. If a concrete pavement is to be built, on a project stating the price per square meter, and the pavement is placed within that price, what will be the gain in showing on Abstract D, Form 13, that so many cubic meters of sand and so many barrels of cement were used? These

Digitized by Google

details, if needed, are to be found in the vouchers for the work and in the office records. Frauds can be discovered only by an inspection of the work.

If the new forms are for the convenience of the auditor merely, it is respectfully submitted that they are a very expensive luxury. It must be remembered that the cost of elaborate paper work can not be measured in money only. The irritation and trouble caused to conscientious officers by elaborate papers which have to be prepared by an ill-trained and often constitutionally inaccurate office force (which is the only kind available in Cuba, at least) should count for much also.

When articles are expended on vouchers, in the administrative audit, whenever that be made, it is a simple and speedy matter to scan each voucher, see that no articles are expended improperly, and see that all nonexpended articles are given on the abstract of property purchased. The last return of property rendered, together with the abstracts, afford an easy means of auditing a new return. In all cases the vouchers themselves should show the work on which the expenditures were made.

Other defects of the forms are as follows:

a. The pay rolls are too small and do not give sufficient room for signatures. There is no provision made for necessary remarks, such as references to authorities for hire, nor for explanations of payments for overtime work. No space is given for check numbers and amounts when payments are made by checks.

The absolute waste of time and labor caused by requiring each name to be signed or attested by mark, with a separate witness signature in each case, is too palpable to require comment, but the practice is hallowed by ancient usage. I have been informed by Mr. Ludlam, skilled accountant, that a decision of the United States Supreme Court has approved a pay voucher, where signatures were not given in receipt, but where the fact of payment was attested by disinterested witnesses. The folly of the entire practice is shown by the frequently necessary and almost universal custom of requiring signatures in advance of payments.

b. Separate forms of vouchers are required for services and for articles. Many contracts include both. The division will be expensive and difficult, if not impossible.

c. There is no form for abstract of funds received. In August of this year there were 21 separate items under this head.

d. Disbursements in the past have been classified into expenditures, deposits, and transfers. Under the new forms they must be placed as purchases, expenditures, transfers, funds deposited; for this last no form is provided. The difficulty mentioned above will arise in the division of contract work into services and materials.

The system of accounts and returns in use in the United States Government work is now antiquated and discarded by all large corporations and business houses. Of all departments of the Government the paper work of the Quartermaster's Department has been most the subject of criticism in the service journals by those who have been compelled to use it. Every officer of experience knows that the system is utterly futile where the desire or motive to make an improper use of property exists. Yet this system is being established in Cuba, where the work of the military officer is supposed to be a model for the instruction of this people in proper methods.

It is earnestly recommended that the new forms be modified and that expert accountants, from civil life, having a knowledge of the methods in use in modern business houses, be employed to devise a system which shall be economical and simple and which, with competent inspectors who will visit personally the works in operation, will afford protection to the Cuban revenues.

A set of the new forms is inclosed.

Very respectfully,

W. M. BLACK,
Major, Corps of Engineers, U. S. A., Chief Engineer.

APPENDIX 2.

WASHINGTON, D. C., *April 20, 1900.*

SIR: In compliance with paragraphs 15 and 16, Special Orders, No. 51, Adjutant-General's Office, March 2, 1900, I have the honor to submit the following report embodying my investigation concerning the practical use of electrozone in the city of Habana, together with the results of tests made to determine the germicidal value of this fluid.

The plant established in Habana by the chief engineer of that department was put into practical operation during the month of July, 1899. The method used for the electrolysis of sea water is that known as the Woolt system, and may be briefly described as consisting of 8 circular open wooden vats arranged in pairs and each capable of holding 1,000 gallons of sea water. For each of the vats there are provided 52 positive and 53 negative electrodes, the former consisting of an alloy of platinum

Digitized by Google

and iridium and the latter of zinc. As stated, these circular vats are connected in pairs, and both receive, at all times when in operation, the same strength of electric current. For the four pairs of vats, therefore, four dynamos are provided.

These vats having been filled at 7 a. m. with sea water, a current having a strength normally of 3,000 amperes, with a voltage of 12–13, is passed through the water for the space of two and one-half hours. At the end of this time 200 gallons (20 per cent, are drawn from each vat and passed into two open wooden receiving tanks, which stand on the street below. Two hundred gallons of sea water are then pumped into each vat to supply the place of that removed, and at the expiration of thirty minutes 200 gallons are again passed from each vat into the receiving tank. This is repeated throughout the day's run.

It is stated that by this procedure there is produced and maintained an average strength of 100 grains of available chlorine to the gallon (0.16 per cent), which would appear to be the strength desired.

The plant is at present at work during eight hours of the day, turning out, as stated by the assistant superintendent, 24,000 gallons of electrozone having a strength of 80 to 100 grains of available chlorine per gallon. The capacity of the plant, if run during the twenty-four hours, is said to be 100,000 galllons of the strength above indicated.

From the receiving tanks, each of a capacity of 5,000 gallons, the disinfectant is drawn off into closed distributing carts at all hours of the day and night, and carried into various parts of the city for sewer, street, and household disinfection. I was informed by Colonel Black, chief engineer, that at present about 12,000 gallons are used daily for sewer disinfection, and about 8,000 gallons for street sprinkling, those streets being selected for daily sprinkling which are located in the old part of the city, where yellow fever has been more prevalent during past years.

For the purpose of sewer disinfection certain water-tight receptacles, having a capacity of several hundred gallons, are provided in connection with the sewers, and from these, by means of a one-half-inch opening, a small stream of electrozone is allowed to flow into the sewer. By this method disagreeable odors have been entirely abated and a certain degree of disinfection supposedly obtained.

As regards household disinfection, I was informed by Maj. W. C. Gorgas, chief sanitary officer, that about 4,000 gallons of electrozone were being daily used for the purpose only of cleansing and disinfecting the floors of such houses as were selected for disinfection, bichloride of mercury solution being relied upon for the disinfection of walls, etc. It will thus be seen that electrozone is being put to practical use in the city of Habana for three purposes, viz, street sprinkling, sewer disinfection, and the disinfection of floors.

After a consideration of the germicidal value of this fluid, I will again refer to its use for these several purposes.

I will here state that at the time of my first visit to the plant (3 p. m., March 11) I was impressed with the fact that although a certain standard of strength as regards available chlorine was supposed to be obtained, this was not arrived at in actual practice. At my request the assistant superintendent kindly tested, by the arsenious-acid test, the fluid contained in two vats, with the result that while one gave 0.319 per cent of available chloride the other contained only 0.073 per cent. A test of the fluid contained in the two distributing tanks gave, for tank No. 1, 0.071 per cent of available chlorine, while that contained in tank No. 2 gave 0.060 per cent. A second test of the fluid contained in tank No. 1, made a half hour later, gave 0.142 per cent of available chlorine.

The varying strength of electrozone, as regards its available chlorine, will be best shown by the results of the tests that were made, from time to time, with the fluid contained in the distributing tanks.

TABLE I.

[Per cent of available chlorine.]

Date.	Tank No. 1.	Tank No. 2.
March 11, 3 p. m	0.071	0.060
11, 3.30 p. m	.142	.....
13, 3.30 p. m	.102	.095
14, 2.30 p. m	.142	.110
15, 2 p. m	.106	.094
19, 11 a. m	.021	.049
20, 8.50 p. m	.056	.052
20, 10 a. m	.071	.070
20, 4.30 p. m	.070	.070

Digitized by Google

Thus, in observations extending over a period of ten days, the amount of available chlorine varied from 0.142 per cent to 0.021 per cent, or from 82.9 grains to 12.2 grains per gallon. The arsenious-acid method was used in determining the available chlorine.

As it will be later shown that the disinfectant value of electrozone depends upon the amount of its available chlorine and that the latter is rapidly lost from the solution, it can be inferred that the fluid in actual daily use must have varied markedly in its disinfectant quality.

Through the courtesy of Colonel Black I was enabled, on March 20, to make a practical test as to the amount of available chlorine which could be produced by the electrolysis of sea water under the Woolf system, and on March 27 to test the capacity of the entire plant during a three hour's run.

For the first test one vat only was selected for observation, although of course the same strength of chlorine was probably produced in its companion vat, but sufficient time could not be given to the estimation of the strength of both vats. The conditions were favorable for the best results, as the electrodes had been thoroughly cleaned and were in good working order. The result of this trial is given in the following table:

TABLE II.

Time.	Percentage of available chlorine.	Grains of chlorine per gallon.	Strength of current.
½ hour	0.046	26.87	3,000 to 35,000 amperes, voltage 12 to 14, acting upon 1,000 gallons of sea water during the period of 8 hours.
1 hour	.078	45.56	
1½ hours	.106	61.92	
2 hours	.129	75.36	
2½ hours	.156	91.13	
3 hours	.191	111.58	
3½ hours	.213	124.43	
4 hours	.248	144.88	
4½ hours	.277	161.82	
5 hours	.323	188.69	
5½ hours	.351	205.05	
6 hours	.379	221.41	
6½ hours	.418	244.19	
7 hours	.433	252.95	
7½ hours	.443	258.80	
8 hours	.454	265.22	

It was observed that during this trial the strength of current supplied to the three remaining pairs of vats varied from 500 to 1,800 amperes. A test of the fluid in two of these, made at 3 p. m., gave only 0.070 per cent of chlorine. This fluid was being passed into the distributing tanks for general distribution. The result of three hours' trial of the entire system of vats is given in the following table:

TABLE III.

Sets.	Time.	Percentage of available chlorine.	Grains of chlorine per gallon.	Strength of current.
No. 1	½ hour	0.024	14.02	
	1 hour	.056	32.71	1,900 A., 13 V.
	1½ hours	081	47.32	2,300 A., 13.5 V.
	2 hours	095	55.49	2,500 A., 13 V.
No. 2	½ hour	053	30.96	
	1 hour	067	39.14	2,500 A., 12 V.
	1½ hours	.078	45.56	
	2 hours	.110	64.26	2,950 A., 12.5 V.
	2½ hours	.142	82.95	
	3 hours	.152	88.79	2,800 A., 12.3 V.
No. 3	½ hour	.031	18.11	
	1 hour	.067	39.14	
	1½ hours	.088	51.40	
	2 hours	.106	61.92	
	2½ hours	.131	76.58	2,400 A., 13 V.
	3 hours	.177	103.40	2,300 A., 12.75 V.
No. 4	½ hour	.042	24.53	
	1 hour	.074	43.23	
	1½ hours	.099	57.83	
	2 hours	.124	72.44	3,400 A., 14.2 V.
	2½ hours	.152	88.79	2,300 A., 12.5 V.
	3 hours	.188	109.82	2,250 A., 12.5 V.

Digitized by Google

During this trial a heavy rainstorm was prevailing, which interfered with the filling of two of the vats, and hence the test with these covered a two hours' run only. A small amount of rainwater entered into the several vats, but not enough it is believed to warrant any alteration of figures. On the contrary, the result obtained in set No. 4 was higher than it would have otherwise been, owing to a leakage of about 200 gallons that occurred during the test, so that the results obtained in sets Nos. 2 and 3 may be taken to fairly represent the capacity of the entire plant during a three hours' run under the most favorable conditions of preparation therefor. It will be seen that the available chlorine obtained amounted to 0.150 per cent and 0.170 per cent, respectively; in other words, that 8,000 gallons of electrozone, having a chlorine strength of 0.160 per cent and 93.47 grains per gallon, can be manufactured every three hours, or a possible 24,000 gallons in a nine hours' run. This result can not be obtained, however, in the regular course of daily work, since much time must be given especially to cleaning electrodes, so that practically two vats are thrown out of use every fifth day. I believe that it would be more correct to say that the plant can produce during a nine hours' run 24,000 gallons of electrozone having a strength of 0.150 per cent or 87.63 grains of chlorine per gallon.

I was informed by one of the gentlemen on duty in the chief engineer's office, who was present during the test, that theoretically a current of 3,000 amperes should produce 20 grains of chlorine per gallon per ampere hour. A calculation made at the end of the 3 hours' run showed, however, that only 12 grains of available chlorine had been obtained per ampere hour.

THE GERMICIDAL VALUE OF ELECTROZONE.

Electrolyzed sea water or electrozone is a clear liquid having a decided odor of chlorine. Its specific gravity appears to be the same as that of the sea water from which it is made, viz, 1027. It bleaches both blue and red litmus paper. This effect is brought about more slowly by solutions containing 0.050 per cent of available chlorine, but takes place at once by solutions having a chlorine strength of 0.100 per cent to 0.250 per cent. Its reaction appears to be neutral. Repeated transfers of small quantities of this fluid to nutritive media showed that it was sterile. In order to ascertain how long the current must flow to bring about the destruction of the bacteria present in the sea water, plates on agar were made from the sea water with which the vats were filled at intervals of 5 minutes for the first hour and then 10-minute intervals during the second hour. The strength of current at the beginning of the observation was 500 A., with 11.5 V. After 5 minutes it had reached a strength of 2,500 A., 11.5 V., and after 7 minutes 3,000 A., 13.5 V. This strength was thereafter continued during the experiment. The material for plating was taken midway between the electrodes and the edge of the vat and at a depth of about 10 inches. The result obtained is given below:

TABLE IV.

Number of bacteria in specimen of sea water	per cc..	832
After 5 minutes of electrolysis	do....	504
After 10 minutes of electrolysis	do....	244
After 15 minutes of electrolysis	do....	338
After 20 minutes of electrolysis	do....	156
After 25 minutes of electrolysis	do....	260
After 30 minutes of electrolysis	do....	54
After 35 minutes of electrolysis	do....	26
After 40 minutes of electrolysis	do....	104
After 45 minutes of electrolysis		None.
After 50 minutes of electrolysis	per cc..	26
After 55 minutes of electrolysis	do....	26
After 60 minutes of electrolysis		None.
After 70 minutes of electrolysis		None.
After 85 minutes of electrolysis		None.
After 100 minutes of electrolysis		None.
After 120 minutes of electrolysis		None.

It would appear therefore that all the bacteria present are destroyed by electrolysis at the end of about one hour. As the number of bacteria per cubic centimeter of Habana harbor water was less than had been anticipated, a second observation was made after the lapse of one week. This test gave 2,158 colonies to the cubic centimeter of sea water, or an average of 1,495 colonies for the two trials.

For the purpose of determining the germicidal value of electrozone, equal parts of this fluid and of bouillon cultures of several micro-organisms, grown in the thermostat, were mixed and transfers made to sterile bouillon tubes after intervals varying from 1 minute to 1 hour. The latter tubes were kept at thermostat temperature from 10 days to 2 weeks and the results carefully noted.

Digitized by Google

TABLE V.—ELECTROZONE CONTAINING 0.050 PER CENT OF AVAILABLE CHLORINE.

[29.21 grains per gallon.]

Cultures.	Time of exposure, in minutes.															
	1	2	3	4	5	7	10	15	20	25	30	35	40	45	50	55	60
Staphylococcus pyog. aureus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bacillus typh	x	x	x	x	x	...	....	....	....	....	....	....	....	....	....	....	....
B. col. com	x	x	x	x	x	x	....	....	....	....	....	....	....	....	....	....	....

Subsequent observations showed that this strength of electrozone did not destroy staphylococcus aureus after 18 hours' exposure.

TABLE VI.—ELECTROZONE CONTAINING 0.100 PER CENT OF AVAILABLE CHLORINE.

[58.42 grains per gallon.]

Cultures.	Time of exposure, in minutes.															
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60	
S. pyog. aureus	x	x	x	x	x	x	x	x	....	....	....	....	....	....	....	
Typhoid bacil	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....	
Colon bacil	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....	
Bac. icteroides	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....	

TABLE VII.—ELECTROZONE CONTAINING 0.150 PER CENT OF AVAILABLE CHLORINE.

[88 grains per gallon.]

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyog. aureus	x	x	x	x	....	....	....	....	....	....	....	....	....	....	....
Typhoid bac	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bacil	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bac. icteroides	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bac. prodigio	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Anthrax spores	x	x	x	x	x	x	x	x	x	....	....	....	....	....	....

TABLE VIII.—ELECTROZONE CONTAINING 0.250 PER CENT OF AVAILABLE CHLORINE.

[146 grains per gallon.]

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyog. aureus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Typhoid bac	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bac	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bac. icteroides	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Anthrax spores	x	x	x	....	....	....	....	....	....	....	....	....	....	....	....

The foregoing observations embraced in Tables V to VIII demonstrate that while solutions containing 0.050 per cent and 0.100 per cent of available chlorine possess to a certain extent germicidal qualities, these solutions can not be considered as efficient disinfectants. In order to bring about the more prompt destruction of the test bacteria, solutions containing 0.150 per cent to 0.250 per cent of available chlorine must be used. It must also be borne in mind that electrozone is a very unstable preparation, and that it rapidly loses its chlorine content, upon which its germicidal value would appear to depend. This is shown in the following table:

TABLE IX.

Date.	Per cent of available chlorine.	Date.	Per cent. of available chlorine.
March 14, 3.30 p. m	0.150	March 15, 10 a. m	0.095
18, 4 p. m	.410	19, 10 a. m	.280
20, 6 p. m	.454	21, 10 a. m	.374
22, 10 a. m	.259	22, 1.30 p. m	.216

Digitized by Google

In the first two observations the sample of electrozone was contained in dark-colored bottles, tightly closed with a cork stopper; in the third it was contained in a Squibbs chloroform bottle with ground-glass stopper and kept in an ice box until reexamined, while in the fourth observation the fluid was purposely left in an open vessel.

To what the instability of this preparation is due, even when kept tightly stoppered in vessels, I am unable to state. It may be attributed either to further oxidation of organic matter present in the solution, or more probably to recomposition of the chemical constituents. At any rate this unstableness of electrozone is fully appreciated by the officer in charge of the plant, and hence an effort is made to use the fluid as soon after its manufacture as possible. Since, however, it is manufactured in open vats and stored in open tanks, it can not fail to continually lose its chlorine strength, and hence to reach its destination with lessened germicidal value.

By reverting now to Table I, it will be seen that the strongest preparation of electrozone found in the distributing tanks during a period of 10 days contained 0.142 per cent of available chlorine, a percentage which was to some extent lessened before its application as a disinfectant. I have already shown that a less chlorine content than 0.150 per cent can not be relied upon for prompt disinfection. A solution containing 0.250 per cent of available chlorine is to be desired. Even a solution of this strength would, after 3 to 6 hours, fall approximately to one containing 0.200 per cent of chlorine. It follows that the electrozone heretofore used in Habana has not possessed sufficient chlorine strength to have rendered it an efficient and reliable disinfectant for practical work.

In order to further test the disinfectant value of electrozone, the following experiments were made:

Experiment I. Equal parts of electrozone (0.130 per cent chlorine) and a thin watery sewage containing more than 5,000,000 bacteria to each cc. were mixed. An agar plate made with one loop of the mixture gave after 1 minute, 25 colonies; after 5 minutes, 10 colonies; and after 1 hour, 4 colonies. A bouillon transfer made after 24 hours gave a growth of nonspore-bearing bacilli.

Experiment II. Equal parts of electrozone (0.250 per cent chlorine) and thin sewage were mixed, with the following results: Plate after ½ minute, 8 colonies; plate after 2 minutes, 2 colonies; plate after 30 minutes, 16 colonies. Bouillon transfer after 24 hours gave a growth of nonspore-bearing bacilli.

The foregoing experiments show that while these examples of electrozone, when mixed in equal parts, did not completely sterilize the sewage, the number of bacteria were promptly and markedly reduced.

Experiment III. Electrozone (0.150 per cent chlorine) was mixed with a sample stool in the proportions of 1 part to 1, 2 parts to 1, 3 parts to 1, and 4 parts to 1 of the stool. The latter was made by adding 10 grams of solid feces to 30 cc. of urine, and the two thoroughly mixed with a glass rod. Some escape of fine gas bubbles to the surface of the liquid was observed. Plates made after 2, 6, and 24 hours gave numerous colonies of the colon bacillus in all the mixtures.

Experiment IV: To a sample stool consisting of 10 grams of feces and 40 cc. of urine, well stirred, were added 150 cc. of electrozone containing 0.280 per cent of available chlorine. There was prompt evolution of numerous fine gas bubbles, which collected as a layer at the surface with temporary bleaching of the amber color of the mixture. A test for the available chlorine in the latter after three hours gave 0.035 per cent. Plates made after 3, 12, and 24 hours gave numerous colonies.

Experment V: Semisolid feces 10 grams, urine 20 cc., and electrozone (0.370 per cent chlorine) 300 cc., or in the proportion of 10 parts of this stronger electrozone to 1 part of stool, were mixed. Bouillon transfers made after 5 minutes, 6 hours, and 24 hours gave a good growth. Agar plates made after 16 and 24 hours gave numerous colonies of nonspore-bearing bacilli.

The foregoing experiments would indicate that where there is much organic matter present, and especially in the form of particles of moderate size, the chlorine content of electrozone (0.370 per cent chlorine) is entirely exhausted prior to the complete disinfection of the mixture.

Where, however, this stronger electrozone is brought in contact with thoroughly decomposed fecal matter, the disinfection may be complete after a comparatively short interval, as shown in the following experiments:

Experiment VI: To a thoroughly decomposed sewage (20,000,000 of bacteria to the cc.) consisting of fecal matter 1 part and urine 30 parts were added varying proportions of electrozone (0.250 per cent chlorine) from 1 to 1 to 6 to 1 of sewage. The solutions made with 1 part of sewage to 5 and 6 parts of electrozone were rapidly bleached with much frothing. Transfers made to sterile bouillon after 2 hours interval gave no growth in any of the mixtures.

Experiment VII: To 1 part of fluid sterile feces, with which a bouillon culture of the typhoid bacillus had afterwards been mixed, was added 4 parts of electrozone

Digitized by Google

(0.250 per cent chlorine). Plates made after 10, 20, 30, and 60 minutes showed no colonies. In other words, in order that these stronger solutions of electrozone may bring about the complete disinfection of sewage, the organic matter must be in a state of extremely fine suspension, which we do not ordinarily find in the practical disinfection of sewage or stools. In all of the foregoing experiments, although disinfection was not accomplished in the majority, the obnoxious odors of all were promptly suppressed by the addition of electrozone.

Returning now to the practical use of electrozone in the city of Habana, I may say that the small quantity allowed to enter the sewers could only act as a deodorizer, and in no sense of the word as a disinfectant. Could the several sewers of the city be filled with this solution and kept full for the period of 24 hours, complete disinfection would hardly be accomplished. It is idle, then, to speak of this agent as a disinfectant for the sewage of the city.

As a surface disinfectant for walls and floors, the stronger solution (0.250 to 0.450 per cent chlorine) will undoubtedly be found effective, but not the weaker solutions heretofore used. For covering the surface of material recently removed from sewers, before it can be carted away, it will accomplish good by surface disinfection and the removal of foul odors.

As regards the matter of street disinfection by sprinkling, it must be remembered that under Colonel Black's supervision the streets of Habana, as far as I was able to judge, are kept in a remarkably clean condition and quite free of all surface refuse. Under these circumstances, far more efficient disinfection is effected by direct sunlight than could be expected from the use of any disinfectant solution. Hence, I can but think that the sprinkling of streets with electrozone is entirely superfluous, except for the purpose of allaying dust.

It only remains to compare the disinfectant qualities of electrozone with solutions of other hypochlorites, such as those of sodium and calcium, containing the same equivalent of available chlorine.

Since my return from Habana I have been engaged in this comparsion, making use of the same method for determining the available chlorine present. The results obtained are recorded below:

TABLE X.—SOLUTION OF SODIUM HYPOCHLORITE, 0.100 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyogenes aureus	x	x	x	x	x	x	x	....	....	....	....	....	....	....	....
Typhoid bacillus	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bacillus	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bacillus icteroides	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....

TABLE XI.—SOLUTION OF SODIUM HYPOCHLORITE, 0.150 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyogenes aureus	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....
Typhoid bacillus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bacillus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Bacillus icteroides	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Anthrax spore	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

TABLE XII.—SOLUTION OF SODIUM HYPOCHLORITE, 0.250 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.								
	1	3	5	7	10	15	20	25	30
S. pyogenes aureus	.....	.....	.....	.....	.....	.....	.....	.....	.....
Typhoid bacillus	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colon bacillus	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bacillus icteroides	.....	.....	.....	.....	.....	.....	.....	.....	.....
Anthrax spore	x	x	.....	.....	.....	.....	.....	.....	.....

Digitized by Google

TABLE XIII.—SOLUTION OF CHLORIDE OF LIME, 0.100 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyogenes aureus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Typhoid bacillus	x	x	x	x	....	....	....	....	....	....	....	....	....	....	....
Colon bacillus	x	x	x	x	....	....	....	....	....	....	....	....	....	....	....
Bacillus icteroides	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

TABLE XIV.—SOLUTION OF CHLORIDE OF LIME, 0.150 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyogenes aureus	x	x	x	x	x	x	x	....	....	....	....	....	....	....	....
Typhoid bacillus	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bacillus	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....
Bacillus icteroides	x	x	x	....	....	....	....	....	....	....	....	....	....	....	....

TABLE XV.—SOLUTION OF CHLORIDE OF LIME, 0.250 PER CENT OF AVAILABLE CHLORINE.

Cultures.	Time of exposure, in minutes.								
	1	3	5	7	10	15	20	25	30
S. pyogenes aureus	x	x	x	x	.....	.....	.....	.....	.....
Typhoid bacillus	x	.....	.....	.....	.....	.....	.....	.....	.....
Colon bacillus	x	.....	.....	.....	.....	.....	.....	.....	.....
Bacillus icteroides	x	.....	.....	.....	.....	.....	.....	.....	.....
Anthrax spores	x	x	x	x	x	x	x	x	x

An examination of the foregoing observations (Tables X to XV) will serve to show that while the solutions of sodium hypochlorite (Labbaraque's solution) of equal chlorine percentage were just as effective in germicidal action as electrozone, the solutions of chlorinated lime were less efficient in their disinfecting qualities, a solution containing 0.250 per cent of available chlorine requiring not less than 10 minutes to destroy Staphylococcus pyogenes aureus and 35 minutes to kill anthrax spores.

In seeking an explanation of this marked difference in action between solutions of electrolyzed sea water and those of bleaching powder, I think that we must take into consideration the difference in the comparative bleaching action of these two solutions. Electrozone bleaches instantly; solutions of chlorinated lime, on the contrary, bleach slowly. In other words, the chlorine content of electrozone would seem to exist as a very unstable hypochlorite, or as free chlorine, which would account not only for its prompt bleaching action, but also for the instability of this fluid. On the other hand, calcium hypochlorite is a most stable compound and gives off its chlorine slowly. If, however, to the solutions of chlorinated lime there is added a small quantity of an acid, such as dilute hydrochloric acid, so as to set free its chlorine and bring the latter into solution, while still preserving the alkalinity of the fluid, then we find that its bleaching effect is just as prompt as solutions of electrozone. Not only this, but its germicidal action is just as effective as electrozone having the same chlorine content.

The following tables will serve to confirm this statement:

TABLE XVI.—SOLUTION OF CHLORINATED LIME CONTAINING 0.100 PER CENT OF AVAILABLE CHLORINE AS FREE CHLORINE.

Cultures.	Time of exposure, in minutes.														
	1	3	5	7	10	15	20	25	30	35	40	45	50	55	60
S. pyogenes aureus	x	x	x	x	x	x	....	....	....	....	....	....	....	....	....
Typhoid bacillus	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....
Colon bacillus	x	x	....	....	....	....	....	....	....	....	....	....	....	....	....
Bacillus icteroides	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....

Digitized by Google

TABLE XVII.—SOLUTION OF CHLORINATED LIME CONTAINING 0.150 PER CENT OF AVAILABLE CHLORINE AS FREE CHLORINE.

Cultures.	Time of exposure, in minutes.								
	1	3	5	7	10	15	20	25	30
S. pyogenes aureus	x	x	x						
Typhoid bacillus	x								
Colon bacillus	x								
Bacillus Icteroides	x	x							

TABLE XVIII.—SOLUTION OF CHLORINATED LIME CONTAINING 0.250 PER CENT OF AVAILABLE CHLORINE AS FREE CHLORINE.

Cultures.	Time of exposure, in minutes.					
	1	3	5	7	10	15
S. pyogenes aureus						
Bacillus Icteroides						
Anthrax spores	x	x	x			

It will be seen, therefore, that chloride of lime, to which hydrochloric acid has been added, in the proportion of 40 parts by weight of the acid to 100 parts of lime, has been rendered by the liberation of its chlorine as effective in disinfectant qualities as electrozone. As care was taken to preserve the alkalinity of the solution, its germicidal action could not be attributed in any way to free hydrochloric acid, but only to the chlorine remaining in solution as free chlorine.

Since chloride of lime and hydrochloric acid are agents that can be readily procured in large quantities and easily stored for use, it does not seem inappropriate to compare the cost of this disinfectant with the cost of electrozone. The latter preparation, I was informed by Colonel Black, was manufactured at a cost of 1.2 mills per gallon, and that to manufacture an electrozone of 0.250 per cent chlorine strength would cost about 2.6 to 2.8 mills per gallon. It must be remembered that in making this estimate no account has been taken of the original cost of the plant, amounting to $75,000, nor of the interest on this sum ($4,500 per annum), nor of the depreciation of the plant, generally computed at 10 per cent per annum. Only the actual daily operating expenses ($37 per day) have been considered.

It is believed that the following calculations will closely approximate the relative cost of chlorinated lime and electrozone as disinfectants: To 1 pound of chloride of lime (7,000 grains), 3 cents; to 1 pound of hydrochloric acid, 3½ cents; 7,000 grains of chloride of lime containing 35 per cent, or 2,450 grains of available chlorine, would make 16.78 gallons of a disinfectant having a strength of 0.250 per cent or 146 grains of chlorine per gallon. Deducting 1.78 gallons as loss of chloride in making the preparations, we have: To 15 gallons of disinfectant, 1 pound of lime, 3 cents; to 15 gallons of disinfectant, one-half pound hydrochloric acid, 1.75 cents; total, 4.75 cents; or at a cost of 3.17 mills per gallon, or for 24,000 gallons a cost of $76.08 per diem.

Since July 1, 1889, to March 31, 1900—234 working days—the total expenditure would have been $17,802 for sufficient chloride of lime and hydrochloric acid to have supplied a disinfectant having 146 grains of available chlorine per gallon. On the other hand we have the following:

Plant	$75,000
Interest at 6 per cent for 9 months	3,375
Daily expenses, $37 for 234 working days	8,658
Total	87,033

as the cost of supplying daily for 234 working days 24,000 gallons of electrozone having no particular standard of strength as regards available chlorine, but certainly of a less strength (see Table I) than 150 per cent.

It seems fair to conclude, therefore, that had the sanitary authorities of Habana resorted to chloride of lime as the disinfectant instead of electrozone, the work of disinfection would have been more thoroughly carried out and the insular funds would have been richer by $69,231.

Digitized by Google

In carrying out the experimental part of this report I desire to state that I have received valuable aid from Acting Assistant Surgeons A. Agramonte, Jesse Lazaer, and James Carroll, United States Army.

WALTER REED,
Major and Surgeon, United States Army.

SURGEON-GENERAL, U. S. A.,
Washington, D. C.
(Through Headquarters Division of Cuba.)

APPENDIX 3.

JULY 30, 1900.

SIR: I have the honor to submit the following comments on the report made by Maj. Walter Reed, surgeon, United States Army, on the electrozone plant in this city, under date of April 20. Major Reed's well-known reputation as a bacteriologist and his known care in experiments entitle his opinion as to the germicidal qualities of electrozone to great weight, and there can be no doubt as to the results he obtained from his experiments. In his comments on the plant, however, there are certain statements which are misleading and which should be corrected.

The inclosed report from Mr. Rowe, in charge of the plant (Inclosure A), shows that during the time in which Dr. Reed was making his tests the plant was run at a decided disadvantage. Mr. Rowe states that Dr. Reed was informed of this, but if so it evidently made little or no impression. At this present time, with 24 hours' run, there is an average daily product of 35,000 gallons of electrozone, of which 4,000 gallons are of 100 grains strength, and 31,000 gallons of 150 grains strength, at a cost of 2.5 mills and 2.75 mills per gallon, respectively. For a fuller statement of results of cost attention is invited to the inclosed extract from the annual report (Inclosure B).

It seems beyond a doubt that at the time of Dr. Reed's visit a lack of judgment, if not carelessness, was shown in the management of the plant, and that electrozone was sent out below the required strength. If such was the case, the blame should be placed on the personnel, where it belongs.

In Table II of Dr. Reed's report, under the head of strength of current, "1,000 gallons of sea water" should read "2,000 gallons of sea water."

The statements regarding the relative cost of chloride of lime disinfectant and of electrozone are also in error.

The cost of chloride of lime here has varied from 4 to 7 cents per pound, the last obtained being 4 cents. Last year at times the higher rate had to be paid. The chloride of lime as obtained here commercially contains 23.06 per cent of available chlorine, not 35 per cent, the theoretical strength given by Dr. Reed. Dr. Reed's attention was invited by me to this increased cost and decreased strength when here. Hydrochloric acid costs here 6 cents per pound.

Again, Dr. Reed's estimate of deterioration of plant is 10 per cent per annum. Accepting these figures, it is certainly wrong in making a comparison of relative costs of electrozone and of other disinfectants to charge in the entire cost of the plant to one year.

Page 21 of the report should then be amended to read as follows:

"It is believed that the following calculations will closely approximate the relative cost of chlorinated lime and electrozone as disinfectants: To 1 pound of chloride of lime (7,000 grains), 4 cents; to 1 pound of hydrochloric acid, 6 cents; 7,000 grains of chlorine of lime containing 23.06 per cent, or 1,614.2 grains of available chlorine, would make 11.06 gallons of a disinfectant having a strength of 0.250 per cent or 146 grains of chlorine per gallon. Deducting 1.06 gallons as loss of chlorine in making the preparation, we have: To 10 gallons of disinfectant, 1 pound of lime, 4 cents; to 10 gallons of disinfectant, one-half pound hydrochloric acid, 3 cents; total, 7 cents, or at a cost of 7 mills per gallon, or for 24,000 gallons a cost of $108 per day.

Since July, 1, 1899, to March 31, 1900—234 working days—the total expenditure would have been $39,312 for sufficient chloride of lime and hydrochloric acid to have supplied a disinfectant having 146 grains of available chlorine per gallon.

On the other hand, we have the following:

One-tenth of plant	$7,500
Interest at 6 per cent for 9 months	3,375
Daily expenses, $37 for 234 working days	8,658
	19,533

as the cost of supplying daily for 234 working days 24,000 gallons of electrozone having no particular standard of strength as regards available chlorine, but certainly of a less strength (see Table I) than 150 per cent."

Digitized by Google

This would have been a more fair statement of the status than that given in the report, although it is not believed nor proved that the strength through the year averaged less than 150 per cent.

It is not believed to be necessary to apologize for the erection of the plant. The conditions in Habana fully warranted the action taken. The death rate and the reports of total sick show conclusively that the various measures taken were effective, and the supply and use of electrozone is one. I do regret that I did not expend a slightly greater sum for the plant, so as to have installed engines and boilers of greater first cost, but of a type more economical in running expenses.

Very respectfully,

W. M. BLACK,
Major, Corps of Engineers, U. S. A., Chief Engineer.

ADJUTANT-GENERAL, DIVISION OF CUBA.

INCLOSURE A TO APPENDIX 3.

ELECTROZONE PLANT, *July 5, 1900.*

Review of the most salient points of Dr. Reed's report.

Electrozone is put to seven different uses in the city of Habana, viz, sewer disinfection; house disinfection by the sanitary department; disinfection of fresh earth on public and private works; street disinfection by sprinkling; disinfection and deodorizing of the "night soil" carts, rendering them inoffensive; disinfection of stables by private owners, and last but not least in relation to the greatest good to the greatest number, it is used as a medicine by the people, both as an antiseptic wash and as an internal drug for various stomach and intestinal diseases. That electrozone is not superfluous in sprinkling the street is evinced by the quick cessation of bad odors in the muddy streets where it is applied.

The low tests taken by Dr. Reed are the result of the reduction in the capacity of the plant on the days in which Dr. Reed made his test, first by Dr. Reed himself, and second by the visit of Secretary Root. Dr. Reed required one dynamo out of the four nearly every day in order to make solutions of various strengths. Many of these solutions were in the neighborhood of 200 grains per gallon, and a solution of over 300 grains per gallon was produced for Secretary Root's visit. This reduction in the amount of power used on the same output in gallons naturally caused a reaction upon the strength of the electrozone produced.

While Dr. Reed did not use any of the machinery on the date of his first visit, Monday, March 11, still his visit was announced in the morning early, and one dynamo was at once reserved for making electrozone of a special strength upon which the visitor might form an opinion favorable to electrozone; and this reservation of the dynamo was made in spite of the fact that the day was Monday and the output was always increased about 4,000 or 5,000 gallons, and to meet this demand we were accustomed to start an hour earlier every Monday. After the first two or three visits from Dr. Reed we began running nine hours per day instead of eight as the necessary complement to his reduction of our available forces. Thus it can readily be seen that Dr. Reed's tests were not a sample of every day's run under normal conditions.

In Table II of Major Reed's report he mentions "3,000 to 3,500 amperes acting upon 1,000 gallons of sea water for 8 hours." He should have said 2,000 gallons of sea water.

At the time of this test Major Reed was informed that our regular fireman was sick, and the substitute, being unaccustomed to our boilers, was unable to maintain more than 60 pounds boiler pressure, while, under normal conditions, our regular fireman keeps from 90 to 100 pounds constantly. Hence Dr. Reed's observation in regard to the amperage of the remaining three sets was wholly one of an occasion. The attendant of the vats and dynamos was instructed to keep the load on Major Reed's dynamo constant at 3,000 amperes, and it was with difficulty that he did it, as the varying steam pressure necessitated the taking the entire load off some of the other machines at times, and at other times loading them up again to prevent the current from going above 3,000 amperes on his machine.

The fact that 3,000 amperes was selected as the current for Major Reed's experiment does not mean that that is the power of the dynamos, but rather that 3,000 amperes is the normal working load when both engines are working at their best.

Digitized by Google

The dynamos could run on 4,500 amperes if the engines could pull that load. As it is, the load always runs above 3,000 amperes on the remaining three machines when one is thrown out for the purpose of cleaning the electrodes. This increase on the three working dynamos amounts to 1,000 amperes apiece, thus compensating for the 3,000 amperes thrown out.

While Major Reed mentions the fact that the trial run of the entire plant made March 27 was conducted during a heavy rain storm, he does not mention the effect that the abnormal atmospheric conditions had upon our fires. In spite of the fact that the regular fireman was at his post and working like a Trojan he could not make the short chimney keep up a good draft, so that the regular working pressure of 100 pounds was impossible.

Dr. Reed's attention was called to this and he was asked to postpone his trial until more favorable weather. This dependence on the atmospheric conditions has since been overcome by installing a mechanical-draft system, which enables us to maintain the regular working pressure under all conditions.

While Professor Wolf claims that the theoretical value of the ampere hour is 20 grains of valuable chlorine per set of electrodes, he does not say that it is ever attainable in practice.

According to Bunsen, "the force of the current must always be great enough to surmount the affinities of the elements in the compound." From this it is readily seen that if a pair of electrodes were supplied with a force just equal to that of the affinities of the elements we wish to separate no action would result.

The additional force that is afterwards applied to do chemical work represents the difference between the theoretical equivalent and the practical attainment. As the result of our practice of 12 grains per ampere hour—or more nearly 12.22—was obtained by a calculation involving the quantity of 3,000 amperes working for 3 hours, for one tank only, Dr. Reed's statement is likely to be erroneously construed, as he failed to multiply this result by 2, or even to mention that the same amount of work was done in the other tank.

REPORT ON CHLORINE SOLUTION PRODUCED BY THE ACTION OF HYDROCHLORIC ACID UPON A SOLUTION OF CALCIUM HYPOCHLORITE.

Test No. 1, June 9, 1900: Chloride of lime taken from the bottom of a barrel at Los Fosos, 1 pound of lime was dissolved in 10 gallons of water, resulting in a milky solution smelling strongly of hypochlorous acid. Many small lumps remained floating on top of the liquid, remaining perfectly dry until mashed between the thumb and finger.

Test by the arsenious-acid method gave 0.230 per cent, or 134.55 grains per gallon, for the solution, or a total of 1,345.5 grains of available Cl in the pound of lime taken, which gives 19.22 per cent of available chlorine contained in the dry lime. This solution was comparatively stable. Test taken every two hours showed no appreciable diminution of available Cl until the end of 14 hours, when the percentage of available Cl in the solution was found to be 0.227 per cent, or 132.48 grains per gallon. This solution was alkaline to litmus and was not very active in bleaching qualities, as it bleached blue litmus only after long exposure.

Test No. 2, June 15, 1900: One pound of a second sample taken made a solution in 5 gallons of water that contained 252.54 grains per gallon of available Cl, making the percentage of available Cl in the dry chloride 18.08. To the 5 gallons of solution made with the above sample, 5 gallons of water containing one-half pound of commercial hydrochloric acid was added. Free chlorine was copiously evolved, the odor of which was so strong as to cause the attendant stirring the mixture to leave his place for fear of being suffocated. After the bubbles of chlorine gas had ceased to escape, the solution was tested and found to contain only 109.71 grains of Cl per gallon, less than half it had before, indicating that considerable Cl had been lost by adding the acid. The bleaching properties were more pronounced. The Cl acted so promptly that it appeared to be in a nascent state. The milky color of the hypochlorite solution was entirely dispelled by the addition of the hydrochloric acid, and a clear green liquid was the result. The green color was due entirely to free chlorine gas in solution, as was afterwards proven by allowing sunlight to fall upon a test tube containing some of the solution, when hydrochloric acid was produced with the liberation of oxygen. As the 10 gallons of solution was found to be still slightly alkaline to litmus, one-fourth pound more of HCl was added, with the usual result of much foaming and free chlorine. The resulting solution was acid to litmus and the available chlorine was only 105.57 grains per gallon.

Test No. 3, June 25, 1900: A sample of calcium hypochlorite taken from a newly opened barrel in Los Fosos was found to contain 23.06 per cent of available chlorine.

Digitized by Google

(The United States Pharmacopœia specified that "0.35 gram of chlorinated lime be titurated with 50 c. c. of water and carefully transferred, together with the washings, into a flask," in making the test for available chlorine in the commercial chloride, and further says that it should contain 35 per cent. Owing to the insoluble nature of a part of the chloride of lime, and the fact that the disinfectant required must be a solution, the chloride contained in the washings must be considered as nonavailable. Hence the tests made were of the available chlorine that went into solution, and not the total amount of available chlorine contained in the dry lime. This partly accounts for the low percentage found.)

One pound of this 23.06 per cent hypochlorite was dissolved in 10 gallons of water. Test gave 161.42 grains per gallon, or 0.276 per cent. Three-fourths of a pound of hydrochloric acid was then added and the solution tested after effervescence had ceased. The following shows loss of available chlorine in mixing as well as loss after mixing, compared with loss in electrozone:

CHLORINE WATER.

Time.	Percentage of grains per gallon.		Time.	Percentage of grains per gallon.	
June 25:	*Before adding HCl.*		June 26:	*After adding HCl.*	
8 p. m	0.276	161.42	2 p. m	0.120	70.38
	After adding HCl.		4 p. m	.085	49.68
8 p. m	0.255	149.04	6 p. m	.071	41.40
10 p. m	.252	146.97	8 p. m	.067	39.33
12 p. m	.244	142.83	10 p. m	.064	37.26
June 26:			12 m	.046	26.91
2 a. m	.241	140.76	June 27:		
4 a. m	.237	138.69	2 a. m	.046	26.91
6 a. m	.230	134.65	4 a. m	.042	24.84
8 a. m	.220	128.74	6 a. m	.039	22.77
10 a. m	.202	117.99	8 a. m	.024	14.49
12 m	.177	105.50	10 a. m	.000	00.00

Or a total of chlorine in 37 hours.

ELECTROZONE.

Time.	Percentage of grains per gallon.		Time.	Percentage of grains per gallon.	
June 25:	*In sun.*		June 27:	*In sun.*	
3 p. m	0.316	184.23	7 a. m	0.234	136.62
5 p. m	.305	178.02	9 a. m	.230	134.55
7 p. m	.301	175.95	11 a. m	.223	130.41
9 p. m	.298	173.88	1 p. m	.220	128.34
11 p. m	.294	171.81	3 p. m	.216	126.27
June 27:			*3-hour periods.*		
1 a. m	.291	169.74	6 p. m	.209	122.13
3 a. m	.284	165.60	9 p. m	.205	120.06
5 a. m	.280	162.63	12 m	.202	117.99
7 a. m	.276	161.46	June 28:		
9 a. m	.273	159.39	3 a. m	.198	115.92
11 a. m	.269	157.32	6 a. m	.195	113.85
1 p. m	.266	155.25	9 a. m	.188	109.71
3 p. m	.259	151.40	*24-hour periods.*		
5 p. m	.255	149.04	June 29, 9 a. m	.166	97.29
7 p. m	.248	144.90	June 30, 9 a. m	.142	82.80
9 p. m	.241	140.76	July 1, 9 a. m	.134	68.66
11 p. m	.241	140.76	July 2, 9 a. m	.0687	51.75
1 a. m	.237	138.69	July 3, 9 a. m	.0745	43.47
3 a. m	.237	138.69	July 4, 9 a. m	.0640	37.26
5 a. m	.234	136.62	July 5, 9 a. m	.0497	28.98

Total time, 9¼ days.

N. B.—After making this last test it was observed that by shaking a bottle of this strength a solution of 0.078 per cent or 45.54 grains per gallon was produced.

At 12 m. the next day after the above-mentioned chlorine solution was made the sunlight shone in the open barrel in which it was standing, thereby enabling the free chlorine to decompose the water and form hydrochloric acid, which was sufficiently plentiful to redden blue litmus at 2 p. m. As soon as the available Cl was all gone, which happened in about thirty-nine hours, a sample was placed in a bottle having a glass stopper and set aside to be used in determining the percentage of HCl present. This I was enabled to do July 6 upon receipt of a normal solution of caustic soda from the city chemist.

Digitized by Google

The solution contained in the above-mentioned bottle contained 0.272 per cent of real hydrochloric acid, thus showing that nearly all the available Cl had gone to form hydrochloric acid.

The market price of chloride of lime and hydrochloric acid in Habana and the resulting price of the disinfectant is as follows: Chloride of lime, 4 cents per pound (given by property clerk, engineer department); hydrochloric acid, 27.9 per cent, 6 cents per pound (from Dr. Johnson's drug store).

Assuming that all the freshly opened barrels of lime contain 23.06 per cent of available chlorine, the following calculation will apply: To 1 pound of calcium chloride (7,000 grains), 4 cents; to three-fourths of a pound of hydrochloric acid 27.9 per cent, 4½ cents. Seven thousand grains of calcium chloride, containing 23.06 per cent or 1,614.2 grains of available chlorine, would make 10.43 gallons of a disinfectant having a strength of 0.263 per cent, or 154.8 grains per gallon. Deducting 0.43 gallons as a loss of chlorine while making this solution, we have cost of 10 gallons of 0.263 per cent of chlorine water, 8½ cents, or at the cost of 8½ mills per gallon.

For a disinfectant made of chloride of lime and acid, having a strength of 0.177 per cent, or 103.5 grains per gallon, we have: To 1 pound of chloride of lime, 4 cents; to three-fourths of a pound of hydrochloric acid, 4.5 cents; cost, 8.5 cents. And as a pound of lime contains 1,614.2 grains of available chlorine, 15.59 gallons could be made having a strength of 0.177 per cent, or 103.5 grains per gallon. Deducting 0.59 gallons as loss of chlorine while making, the cost of 15 gallons of chlorine water is 8½ cents, or 5.66 mills per gallon. For 24,000 gallons, a cost of $135 per diem.

Actual cost of electrozone having a strength of 0.177 per cent, or 103.5 grains per gallon, for month of May (1–10) was 2.46 mills per gallon. For 24,000 gallons, $59.04 per diem.

Actual cost of making electrozone under ordinary normal conditions, and with a product of 6,400 gallons, 100 grains strength, and 26,400 gallons, 150 grains strength, per day is, for the 100-grain strength, $0.00250, and for 150-grain strength, $0.00275, which for a strength of 0.263 per cent, or 154.8 grains per gallon, $0.002757.

In addition to the above observations, it is well to note that true calcium chloride ($CaCl_2$), which is the complement of the action of liberating chlorine when the hypochlorite is treated with hydrochloric acid, forms insoluble ($CaCo_3$) calcium carbonate, when in a solution that is in contact with the air. Where such disinfectant is used in large quantities in disinfecting sewers, the carbonate deposited might in time interfere with the flowing of sewage, thereby more than counterbalancing the virtues of the original disinfectant.

INCLOSURE B TO APPENDIX 3.

ELECTROZONE PLANT.

[Mr. G. C. Rowe in local charge.]

Previous to October 1, 1899, the plant was operated under the direction of the mechanical engineer department and the street department.

The output of electrozone during the months of August, September, and October, 1899, amounted to about 16,000 gallons per day, with the plant running eight hours and delivering the electrozone at an average strength of 65 grains of available chlorine to the gallon.

This output has increased steadily, so that at the end of June it amounted to 24,800 gallons per day, delivered at an average strength of 150 grains of available chlorine to the gallon, the plant running fifteen hours without increasing the crew.

Improvements are under way to increase the output capacity of the plant, without increasing the cost of labor.

A deposit forms quite rapidly in the tanks in which the electrolytic action takes place. This deposit has been analyzed, showing it to contain hydroxides of zinc, calcium, and magnesium. More careful analyses are now being made.

Statement of operation of plant.

Number of gallons of electrozone produced in twelve months, 6,469,270.

Total cost of materials (twelve months)	$7,616.01
Total cost of labor (twelve months)	6,160.70
Royalty (twelve months)	3,474.73
Total	17,251.44
Average cost of one gallon of electrozone	.00266667

Digitized by Google

Cost of electrozone per gallon; of average strength of 150 grains free chlorine; plant running fifteen hours per day, with an output of 24,828.7 gallons per day.

Cost of operating plant, per 1,000 gallons:	
483.31 pounds coal	$1.3291
102 pounds waste	.0015
.002 gallon oil	.014
Total cost of material	1.3446
Labor and direction	.66
	2.0046
Royalty per 1,000 gallons	.75
Total cost per 1,000 gallons	2.7546
$\frac{2.7546}{1,000}$ equals total cost per gallon	.0027546

With a view to determine the relative cost of the production of electrozone by adding common salt to the sea water, experiments were made, developing the following results:

Curves taken from two test runs, one with sea water alone, the other with sea water to which salt had been added, show a decided gain in the rate (per unit of time) of electrolytic action, making electrozone in favor of the sea water with salt added.

This was effected at an expense of 440 pounds of salt for each of the two tanks in series, or a total of 880 pounds of salt.

The following shows the amount of coal saved thereby:

H. P. furnished by two engines	200
Hours run per day	15
H. P. hours	3,000
Pounds of coal burned per day	12,000
Pounds of coal per H. P. hour	4
H. P. hours required to produce 2,000 gallons electrozone of 100 grains per gallon:	
From sea water	156.139
From sea water with salt	98.132
H. P. hours saved	58.007
At 4 pounds coal per H.P. hour, coal saved, $4 \times 58.007 = 232.028$ pounds.	
Price of salt per pound, $0.01—total cost of salt	$8.80
Price of coal per pound, $0.00275—total cost of coal	.638
Total money saved	−8.162
H. P. hours required to produce 2,000 gallons of electrozone of 200 grains per gallon:	
From sea water	320.08
From sea water with salt	209.78
H. P. hours saved	110.30
At 4 pounds of coal per H. P. hour, coal saved, $4 \times 110.30 = 441.21$ pounds.	
Price of salt per pound, $0.01—total cost of salt	$8.80
Price of coal per pound, $0.00275—total cost of coal	1.2133
Total money saved	−7.5867
While the saving in H. P. hours is 110.3, the cost of salt more than offsets that saving.	
Calculated output of 24-hour day, sea water alone, at 200 grains per	30,000 gallons
Calculated output of 24-hour day, sea water with salt, at 200 grains per	45,760 gallons

Calculated cost per gallon:	
200 grains sea water	$0.0034359
200 grains sea water, with salt added	.0072292
150 grains sea water	.0027546
150 grains sea water, with salt added	.00668
100 grains sea water	.00203426
100 grains sea water with salt added	.006115226

The saving in time resulting from the addition of salt to the water is more than offset by the cost of the salt, and is therefore uneconomical unless the output of the plant is required to be more than the 30,000 gallons per twenty-four hours, with strength of 200 grains free chlorine per gallon.

If the exhaust steam were utilized to evaporate sea water to a greater density, so as to avoid the purchase of salt, a decided economy would result. Steps are being taken looking to this end.

GENERAL OFFICE FORCE.

[Mr. H. F. Happer, chief clerk.]

The force has charge of the general affairs of the office and of keeping the records, and consists at present of 13 clerks, 7 of whom are at present employed on record work.

Digitized by Google

The record division is directly under Mr. F. Zimmerman, record clerk. Prior to September, 1900, each of the subdepartments kept its own records, the main record office handling only papers which reached the chief engineer. During September the records of the subdepartments were consolidated with the records of the chief engineer, and since that time all papers have been recorded in this division, increasing the efficiency of the work and decreasing the expense of such work for clerical assistance.

The War Department card system is used, with such modifications as have been found necessary to handle "expedientes"—records of a case which have been made up according to the Spanish system of recording.

The following is a statement of the work done:

Letters received	9,129
Letters sent	1,848
Indorsements of chief engineer	4,558
Indorsements received back	3,492
Total	19,027
Number of cases recorded to July 1, 1900	11,223
Number of new cases recorded from July 1, 1900, to December 31, 1900	3,043
Number of cases since organization	14,266

PAY DEPARTMENT.

[Mr. Wm. C. Strong, paymaster.]

This department, which during the last fiscal year embraced the voucher division, in charge of Mr. N. B. Stewart, voucher clerk, and the pay-roll division, in charge of Mr. H. H. McGinty, has retained the same chiefs of division. The organization and personnel has, however, been increased, a division of bookkeeping having been recently added to relieve the offices of the various assistant engineers of the trouble of keeping account of liabilities and to accomplish that work at a much less cost in stationery and clerk hire and with the greatest practicable dispatch and accuracy. This division of bookkeeping, at present in temporary charge of a clerk from the pay-roll division, is in practical operation, and its organization now nearly completed. All requisitions from assistant engineers for material and supplies pass through this division, where the duplicate is retained and the original thence forwarded promptly to the property department for purchase in accordance with the regulations. The duplicate purchase orders are sent from the property department to the division of bookkeeping simultaneously with the issuance of the original, and the amounts of service liabilities and payments are obtained soon after they occur from the pay roll and voucher divisions, thus enabling record under each account on the same ledger page of receipts and expenditures, amount of project, liabilities unpaid, balance available, general and subhead of appropriation, file references, etc.

The operations of the pay department, which have been in process of improvement in method since its organization, consist in receiving and disbursing funds pertaining to the engineer department, keeping its financial accounts and records, attending to correspondence pertaining to payments, the preparation of money papers, financial statements, vouchers, and pay rolls. It has, by attention to such duties, enabled the engineer officer in charge and his assistant engineers to devote their time, as nearly as possible, wholly to engineering work, while full supervision is maintained over all payments.

Payments to laborers are made twice per month in the presence of the superintendent of the work done by them and in the presence of their foremen or capataces at hours and places most convenient and economical, the money being counted to them in cash in the presence of all concerned and recounted by them before leaving the place of payment. After payment of all presenting themselves the cash is balanced with the amounts due absentees in the presence of those who remain. It is believed that this procedure of counting the money in the presence of all, without the use of pay envelope, has brought about the most complete confidence among the laborers of the engineer department. The pay department has spared no effort to convince the laboring class of the absolute fairness of the engineer department methods. Payments are made in cash, in presence of proper witnesses, to sick laborers at their homes after business hours when time does not permit during the day. Men who fail to appear at the appointed time and place are paid upon "back pay days," which occur semimonthly.

The number of laborers on the rolls at present is 3,440, and monthly employees, in which are included all above the grade of laborer or mechanic, number 446; a total departmental force of 3,886 men.

Digitized by Google

An examination and audit of the books and accounts of the engineer department, which was begun June 19, 1900, by Messrs. Haskins & Sells, certified public accountants of New York, in compliance with instructions of the military governor, was completed July 21, 1900, having engaged the whole time of two experts for more than a month. The following is quoted from their report: "We have verified all receipts and expenditures shown by the records of the department by an investigation of each item of income and disbursement. We have verified the balance on hand by an actual count of the cash and the balance on deposit in bank by proper certificates from the different depositories, and we hereby certify the receipts of the department have been properly accounted for, that all of the disbursements have been duly authorized and made on properly approved and receipted vouchers, and that the balance on hand June 19, 1900, was correct according to the records of the department."

A military inspection was also made under date of July 22, 1900, by Maj. R. H. Rolfe, inspector-general, under whose direction the aforesaid inspection was conducted. This latter inspection covered the period from the previous military inspection to and including June 19, 1900. The inspection report contained the following certificate by the inspector-general: "I hereby certify that I have inspected these accounts and verified the statements, and these disbursements, records, accounts, and deposits seem to be proper and to conform strictly with the law and orders."

An average of 615 vouchers per month have been prepared and paid during the six months ending December 31, 1900, an increase of 205 per month over the average for the last fiscal year. This increase was due to variety in modes of purchase, increase in the number of accounts, and to new forms for rendition of vouchers which make distinction between expenditures and purchases, and accordingly necessitate separate vouchers in many cases where formerly one sufficed.

A financial statement showing the disbursements of the engineer department, city of Habana, during the period from July 1 to December 31, 1900, accompanies this report. The disbursements therein shown for this period amount in total to $811,758.77.

During the period of this report, as previously, the paymaster of this department has been receiving and disbursing division (now department) of Cuba funds under the direction of the chief engineer, division (now department) of Cuba. These disbursements, amounting to $193,742.64, are shown on a separate financial statement accompanying. All services rendered by the pay and property departments in connection with the works under the chief engineer of the department of Cuba were paid for from funds allotted for the engineer department, city of Habana.

Under proper authority work has been done by the engineer department for private firms—chiefly with the dredging plant—and also for the ayuntamiento of Habana. This work was paid for by those for whom it was done, and the amounts are also shown upon the financial statements appended.

The total disbursements of the pay department during the six months' period covered by this report aggregate $1,005,501.41. The transactions of the department, however, involving transfers, deposits, etc., amount to a much larger sum.

Statement of expenses incurred and payments made in the engineer department, city of Habana, from July 1 to December 31, 1900, together with outstanding liabilities on December 31, 1900.

Appropriation.	Payments.		Total.	Liabilities outstanding Dec. 31, 1900.	Total expenses incurred July 1 to Dec. 31, 1900.
	1900.	1901.			
PUBLIC WORKS.					
Construction and repair:					
For improvement of Cortina de Valdes	.....	$3,383.04	$3,383.04	$71.57	$3,454.61
For improving La Fuerza	.....	1,119.33	1,119.33	240.05	1,359.38
Total	.....	4,502.37	4,502.37	311.62	4,813.99
MUNICIPALITIES.					
Police:					
For work at third police station[a]	.....	97.85	97.85	.....	97.85
Sanitation:					
For street cleaning	$13,492.92	98,487.84	111,980.76	[b] 168.83 9,354.13	107,841.97
For collection of refuse	7,569.69	59,675.58	67,245.27	[b] 101.10 4,422.90	64,098.48

[a] Funds from ayuntamiento. [b] Fiscal year 1900, liabilities.

Digitized by Google

Statement of expenses incurred and payments made in the engineer department, city of Habana, from July 1 to December 31, 1900, etc.—Continued.

Appropriation.	Payments.		Total.	Liabilities outstanding Dec. 31, 1900.	Total expenses incurred July 1 to Dec. 31, 1900.
	1900.	1901.			
MUNICIPALITIES—continued.					
Sanitation—Continued.					
For disposal of refuse (removal to sea)	$7,249.41	$32,907.93	$40,157.34	[a] $317.08 5,060.21	$37,968.14
For disposal of refuse (cremation)	1,653.74	2,245.22	3,898.96	[a] 2.50 314.24	2,559.46
For parks, preservation and care of	3,440.36	23,070.81	26,511.17	[a] 79.29 2,281.56	25,352.37
For parks, watchmen, day and night	1,468.85	9,815.26	11,284.11	836.82	10,652.08
For city stables, stable No. 2	8,676.74	32,830.59	41,516.33	[a] 17.50 9,026.37	41,865.96
For city stables, stable No. 3	5,112.46	19,407.93	24,520.39	[a] 76.27 3,290.45	22,698.38
For street cleaning, repair shops	2,340.91	10,467.38	12,808.29	[a] 57.53 788.17	11,255.55
For street sprinkling	1,787.81	13,218.78	15,006.59	2,017.51	15,236.29
For Regla, street cleaning	329.69	2,532.44	2,862.13	251.30	2,783.74
For Guanabacoa, sanitary cleaning and repairs to streets and roads	864.25	2,019.39	2,883.64	.....	2,019.39
For construction of sea wall at La Punta	.....	8,846.94	8,846.94	1,044.52	9,891.46
For grading and cleaning lots around portions of old city wall	.....	4,103.58	4,103.58	103.91	4,207.49
For extending sewer at north end of Tacon street	.....	348.34	348.34	79.46	427.80
For purchase of three sprinkling wagons	1,500.00	.....	1,500.00	.....	.....
For repairs to tug "Narciso Deulofeu"	.....	4,263.07	4,263.07	8,726.93	12,990.00
For repairs to streets [b]	32,086.98	68,259.30	100,346.28	10,323.82	78,583.12
For Regla, repairs to streets	.....	2,378.01	2,378.01	812.97	3,190.98
For Vento stone-crushing plant and quarry	.....	46,700.76	46,700.76	8,285.52	54,986.28
For surveys for establishment of street grades	3,577.27	18,908.52	22,485.79	768.65	19,677.17
For repairs to streets and changes of grades necessitated by street-railroad work	.....	15,245.27	15,245.27	630.01	15,875.28
For Habana Electric Railway Company [c]	.....	1,940.00	1,940.00	.....	1,940.00
For brick paving through gateway to general wharves of Habana	.....	321.54	321.54	49.84	371.38
For cross sectioning and profiling streets	.....	1,562.65	1,562.65	66.00	1,628.65
For Fosos repair shops	4,144.11	10,990.77	15,134.88	[a] 205.38 749.99	11,740.76
For laying water pipe on Zequeira street, between Consejero, Arango, and Zarabia streets [c]	.....	92.53	92.53	1.29	93.82
For water department	7,250.13	37,273.49	44,523.62	[a] 1,907.55 3,532.21	40,805.70
For maintenance of Palatino and Zanza Real	367.82	4,150.43	4,518.25	[a] 23.13 824.15	4,974.58
For maintenance of Palatino pumping station	1,052.93	6,300.60	7,353.53	481.25	6,781.85
For water supply to Regla and Luyano	3.00	.....	3.00	[a] 16.50	.....
For improvement of water supply to camp, Columbia, Quemados, and Principe	10,354.94	1,774.22	12,129.16	13,590.00	15,364.22
For installation of water pipe at Tamarinda station [c]	275.18	70.50	345.68	3.04	73.54
For installation and removal of water meters for Habana Electric Railway Company [d]	.....	49.58	49.58	366.50	416.08
For water department, work on account of Habana Electric Railway Company [d]	.....	442.33	442.33	.....	442.33
For installation of public fountain at Casa Blanca [c]	.....	230.44	230.44	.....	230.44
For repairs to urinals, Olavarrieta School [c]	.....	11.74	11.74	.90	12.64

[a] Fiscal year 1900, liabilities.
[b] Liabilities on Vento stone-crushing plant and quarry outstanding July 1 were paid from this allotment.
[c] Funds from ayuntamiento.
[d] Funds from Habana Electric Railway Co.

Digitized by Google

Statement of expenses incurred and payments made in the engineer department, city of Habana, from July 1 to December 31, 1900, etc.—Continued.

Appropriation.	Payments. 1900.	Payments. 1901.	Total.	Liabilities outstanding Dec. 31, 1900.	Total expenses incurred July 1 to Dec. 31, 1900.
MUNICIPALITIES—continued.					
Sanitation—Continued.					
For replacing wood floor and enlarging porch at Tacon 3				$201.27	$201.27
For sewer department	$4,614.22	$36,612.41	$41,226.63	[a] 133.50 4,676.48	41,288.89
For night soil department (removal of night soil)	1,264.61	12,610.51	13,875.12	[a] 21.30 1,094.01	13,704.52
For electrozone plant	2,357.23	12,828.61	15,185.84	[a] 507.21 5,756.67	18,585.28
For repairs to sewers at Reina Mercedes Hospital		1,787.39	1,787.39	.45	1,787.84
Total	122,835.25	604,791.68	727,626.93	104,011.23	704,605.18
Hospitals and charities:					
(1) For reconstruction of house of succor, Casa Blanca	5.95		5.95	2.52	2.52
Miscellaneous:					
For general repairs and superintendence municipal buildings	2,142.62	13,042.62	15,185.24	[a] 10.05 [a] 57.14	13,999.76
For renovation and repair of Hospital Militar for use as carcel	80.25		80.25	[a] 21.28	
For new iron closet at Vivac[b]		3.84	3.84		3.84
For repairs to ceiling of mayor's office[b]		12.58	12.58		12.58
For repairs to beef slaughterhouse and removal of swine slaughterhouse to same[b]	2,287.81	4,949.93	7,137.74	[a] 15.02	4,849.93
For urgent work at Tacon market[b]	290.14		290.14		
For repairs to skylight at police department building[b]		74.75	74.75		74.75
For enlarging cemetery at Arroyo Naranjo[b]		6.36	6.36		6.36
For work at dog pound[b]		65.00	65.00	74.70	139.70
For repair to lightning rods at Maestranz[b]		35.36	35.36		35.36
For repairs to Tacon market[b]		212.75	212.75		212.75
For repairs at Colon market[b]	1,066.04	2,501.10	3,567.14		2,501.10
For employees and incidental expenses of municipal architect's department	1,338.83	8,112.27	9,451.10	242.17	8,354.44
For employees and incidental expenses of administration engineer department	4,770.64	31,170.46	35,941.10	22.50	31,192.96
For office furniture and supplies	1,233.04	1,275.51	2,508.55	627.89	1,903.40
For construction of 50 signs for fire department[b]		12.60	12.60	27.25	39.85
For work at Eleventh police station, 377 Jesus del Monte[a]				415.00	415.00
Total	18,209.37	61,375.13	74,584.50	2,413.00	63,741.78
MILITARY DEPARTMENT, BARRACKS AND QUARTERS.					
For construction of military stable	1,282.94		1,282.94		
For installation of two new boilers at Cerro pumping station	8,240.00		8,240.00		
Total	4,522.94		4,522.94		
MILITARY DEPARTMENT, ADMINISTRATION AND RURAL GUARD.					
For making all necessary arrangements to prevent serious deterioration of the property of the Habana Brick Co., and employment of necessary watchmen		418.23	418.23	48.67	466.90

[a] Fiscal year 1900, liabilities.

[b] Funds from ayuntamiento.

Digitized by Google

Statement of expenses incurred and payments made in the engineer department, city of Habana, from July 1 to December 31, 1900, etc.—Continued.

RECAPITULATION.

Appropriation.	Payments. 1900.	Payments. 1901.	Total.	Liabilities outstanding Dec. 31, 1900.	Total expenses incurred July 1 to Dec. 31, 1900.
PUBLIC WORKS.					
Construction and repairs: From customs funds	.....	$4,502.37	$4,502.37	$311.62	$4,813.99
MUNICIPALITIES.					
Police: From ayuntamiento funds	.....	97.85	97.85	.....	97.85
Sanitation: From customs funds	$122,560.07	601,954.56	724,514.63	*4,197.73 / 99,441.77	701,396.33
From miscellaneous funds	.....	2,431.91	2,431.91	366.50	2,798.41
From ayuntamiento funds	275.18	405.21	680.39	5.23	410.44
Hospitals and charities: From ayuntamiento funds	5.96	.....	5.96	2.52	2.52
Miscellaneous: From customs funds	9,565.38	53,600.86	63,166.24	*31.33 / 1,840.70	55,450.56
From ayuntamiento funds	3,643.99	7,774.27	11,418.26	*15.02 / 516.95	8,291.22
Total	136,050.57	666,264.66	802,315.23	106,426.75	768,447.33
MILITARY DEPARTMENT.					
Barracks and quarters: From customs funds	4,522.94	.....	4,522.94	.....	.....
Administration and rural guard: From customs funds	.....	418.23	418.23	48.67	466.90
Total	4,522.94	418.23	4,941.17	48.67	466.90
Grand total	140,573.51	671,185.26	811,758.77	106,787.04	773,782.22

Statement of expenditures from January 1, 1899, to December 1, 1900, of the engineer department, department (afterwards city) of Habana, including expenditures for works carried on under the immediate direction of chief engineer, division (afterwards department) of Cuba.

	Expended Jan. 1, 1899, to June 30, 1900.	Expended July 1 to Dec. 31, 1900.	Total.
For expenditure in renovation, sanitation, and repairs of buildings prior to May 1, 1899, which can not be classified, as amount expended on each building was not kept separate*	$72,973.24	.....	$72,973.24
For renovation and repairs to department headquarters (including buildings occupied by military governor of Habana, lieutenant-governor's palace, and offices of chief engineer)	9,459.08	.....	9,459.08
For renovation and repairs to batteries 3, 4, and 5	13,185.75	.....	13,185.75
For renovation and repairs to custom-house	5,818.00	.....	5,818.00
For renovation and repairs to cuartel de la Fuerza	8,437.97	.....	8,437.97

*The buildings cleaned and renovated comprised: Military governor's palace and adjoining offices, Hospital Militar, custom-house, buildings at Reina Battery, at la Fuerza, Santa Clara Battery, Intendencia Militar, Compostela, and Paula street barracks and their outlying buildings, widow's home, cuartel de Dragones, Maestranza de Artillería, buildings at La Punta, buildings in the Morro and Cabaña fortresses, batteries Nos. 1, 2, 3, 4, and 5, Pirotecnia, department yellow fever hospital, two magazines between Cabañas and Fort San Diego, buildings at Fort Principe, and the department stables. Of these, the custom-house, Reina Battery, Santa Clara Battery, cuartel de Dragones, Maestranza de Artillería, La Punta, the offices in rear of the military governor's palace, batteries Nos. 3, 4, and 5, and the department stables were prepared for occupation by the officers and troops of the United States forces. The Hospital Militar, La Fuerza, Compostela, and Paula street barracks, the Morro and Cabaña, buildings at Fort Principe, and batteries 1 and 2 were cleaned and repaired so as to cause them to cease to be a source of infection and to fit them for use. The Intendencia Militar was prepared for the police headquarters of the city, the widow's home for an asylum, and two magazines as storehouses for explosives; the military governor's palace and the adjoining buildings to receive the city offices and the office of the Obras del Puerto.

Digitized by Google

Statement of expenditures from January 1, 1899, to December 1, 1900, of the engineer department, department (afterwards city) of Habana, etc.—Continued.

	Expended Jan. 1, 1899, to June 30, 1900.	Expended July 1 to Dec. 31, 1900.	Total.
For repairs to cuartel de la Fuerza, for storing archives of Cuba	$4,223.11	$296.59	$4,519.70
For purchase and installation of electric-lighting plant at La Fuerza and wiring La Fuerza palace of governor-general, Segundo Cabo, and house of captain of the port	2,967.24	30,347.68	33,314.92
For improving La Fuerza (restoring moat, etc.)	.....	1,119.33	1,119.33
For renovation and repairs to Reina and Santa Clara batteries	2,705.10	.....	2,705.10
For repairs to intendencia militar	3,907.23	.....	3,907.23
For repairs to Compostela street barracks for orphan asylum	27,040.90	.....	27,040.90
For renovation and repairs to Paula street barracks	511.27	.....	511.27
For renovation and repairs to Dragones barracks	1,275.00	.....	1,275.00
For Dragones barracks, for converting into correctional court	.....	14,412.63	14,412.63
For renovation and repairs to Maestranza de Artilleria	9,369.91	.....	9,369.91
For repairs to lightning rods at Maestranza[a]	.....	35.36	35.36
For renovation and repairs to La Punta	5,511.69	.....	5,511.69
For renovation of Morrow and Cabana	8,919.97	.....	8,919.97
For repairs to powder magazines, Santa Barbara and San Elmo	515.00	.....	515.00
For renovation and repairs to batteries 1 and 2 and Velasco	5,133.00	.....	5,133.00
For renovation and repairs to Castillo del Principe	765.97	.....	765.97
For renovation and repair of old post-office	20,749.39	.....	20,749.39
For repairs to Widows' Home	6,686.67	.....	6,686.67
For repairs to municipal vivac	16,888.57	.....	16,888.57
Vivac, addition for use as court room	.....	1,297.92	1,297.92
For installation of iron closets at vivac[a]	389.96	3.84	393.80
For renovation and repairs to Belascoain Barracks	6,662.72	.....	6,662.72
For repairs to Belascoain Barracks (for medical department)	2,093.79	58.50	2,152.29
For renovation and repairs to governor-general's palace	34,584.66	.....	34,584.66
For plants, governor-general's palace	750.00	.....	750.00
For general repairs and superintendence municipal and state building[b]	24,976.49	15,185.24	40,161.73
For renovation and sanitation of buildings[c]	9,243.47	.....	9,243.47
For conversion of Cabana into a presidio	2,393.34	.....	2,393.34
For repairs to hospital militar for use as carcel	25,268.80	80.25	25,349.05
For repairs to Santo Venia Quinta (Hermanitas de los Pobres)	3,212.61	.....	3,212.61
For construction of military stable	10,246.01	1,282.94	11,528.95
For repairs to infirmary of presidio	1,919.76	.....	1,919.76
For building stable, house of succor, Amistad No. 78[a]	436.08	.....	436.08
Special fund for emergency repairs to city properties:[a]			
For repairs to bromotological laboratory $149.25			
For repairs to Casa Socorro No. 471 Monte street. 238.09			
For repairs to bacteriological laboratory 6.30			
	393.64	.....	393.64
For repairs to Police Station No. 4[a]	79.22	.....	79.22
For repairs to Reina Battery for use by inmates of San Jose Asylum[a]	154.43	.....	154.43
For installation of electric lights and emergency closets at San Jose Asylum (Reina Battery)	27.55	.....	27.55
For installation at San Jose Asylum (Reina Battery) of part of cooking and boiling apparatus from Beneficencia	185.22	12.64	197.86
For repairs to Colón Market	1,510.74	.....	1,510.74
For repairs to Colón Market[a]	.....	3,567.14	3,567.14
For repairs to Hospital de Higience[a]	1,438.00	.....	1,438.00
For renovation of the beneficencia	32,092.44	737.71	32,830.15
For monthly pay and expense roll of municipal architect	24,504.94	9,451.10	33,956.04
Repairs to Tacón Market	2,460.40	.....	2,460.40
For urgent work at Tacón Market[a]	408.82	290.14	698.96
For repairs to Tacón Markets[a]	.....	212.75	212.75
For repairs to governor-general's summer residence	152.24	.....	152.24
For repairs to Jesús del Monte School	1,600.00	.....	1,600.00
For repairs to School 75, Seventh street, Vedado	236.75	.....	236.75
For repairs second house of succor	67.42	.....	67.42
For renovation and installation plumbing and laundry at Aldecoa Hospital	27,832.46	.....	27,832.46
For repairs to Estevez street police station	10.00	.....	10.00
For repairs to Estevez street school	627.60	.....	627.60
For repairs to cuartel de Bomberos	826.29	.....	826.29
For construction of stalls, cuartel de Bomberos[a]	2,172.45	.....	2,173.45
For renovation and repairs to Recogidas Prison	4,525.50	.....	4,525.50

[a] Expenditures made from funds furnished by ayuntamiento.

[b] This item includes repairs to municipal and state buildings partly of an emergency nature, and in most instances not aggregating more than $250 for any single work; payment of salaries for superintendence of repairs to all public buildings for which special and separate allotments were made.

[c] Expenditure under this head was to cover cost of renovation and sanitation of buildings both public and private when work was of an emergency nature, but where expense in each case was comparatively small.

Digitized by Google

Statement of expenditures from January 1, 1899, to December 1, 1900, of the engineer department, department (afterwards city) of Habana, etc.—Continued.

	Expended Jan. 1, 1899, to June 30, 1900.	Expended July 1 to Dec. 31, 1900.	Total.
For employees and incidental expenses, administration, engineer department [a]	$62,520.08	$35,941.10	$98,461.18
For office furniture and supplies [b]	17,369.84	2,508.55	19,878.39
For survey of fortifications [c]	15,574.73	11,731.77	27,306.50
For operation of dredging plant, care and repair of wharves, and cleaning harbor front [d]	121,106.37	34,481.75	155,588.12
For dredging for United Railways of Habana [e1]	14,638.40	508.61	15,147.01
For dredging for Almacenes de deposito de la Habana [e2]	450.00	160.00	610.00
For dredging for Empresa de Almacenes de Hacendados [e3]	1,000.00	.....	1,000.00
For boring for Habana Electric Railway Co. [e4]	249.50	.....	249.50
For dredging at site of dry dock Krajewski Pesant Co. [e5]	6,665.62	10,070.83	16,736.45
Dredging for R. Truffin & Co. [e6]	1,798.14	.....	1,798.14
For dredging Slaughter House Creek	4,162.27	.....	4,162.27
For repairs to Luz wharf	12,913.11	.....	12,913.11
For repairs to dredge Comercio	3,640.30	2,134.30	5,774.60
For repairs to audiencia and carcel	863.10	37,788.64	38,651.74
For materials necessary for cleaning and whitewashing walls at carcel	111.00	272.62	383.62
For paving with cement tiles the wooden floor of smallpox ward at Las Animas [d]	360.00	.....	360.00
For renewing gas-pipe and fixtures at presidio and presidio hospital	770.00	.....	770.00
For purchase and installation of two new boilers at Cerro pumping station	4,862.29	3,240.00	8,102.29
For reconstruction of house of succor, Casa Blanca [d]	523.28	5.95	529.23
For repairs to beef slaughterhouse and removal of swine slaughterhouse to same [d]	2,116.58	7,137.74	9,254.32
Repairs to ceiling of mayor's office [d]	.....	12.58	12.58
For repairs to skylight of police department building [d]	.....	74.75	74.75
Enlarging cemetery at Arroya Naranjo [d]	.....	6.36	6.36
For work at dog pound [d]	.....	65.00	65.00
For construction of 50 signs for fire department [d]	.....	12.60	12.60
For improvement of Cortina de Valdés	.....	3,383.04	3,383.04
For work at third police station [d]	.....	97.85	97.85
For Artarés Castle, for repairs and addition to fit for use as prison	.....	794.50	794.50
For passenger landing, construction of	.....	4,102.48	4,102.48
For moving 2 barrack buildings from Cabana to quarantine station near San Diego Battery and equipping same	.....	18,555.28	18,555.28
For demolition of Monserrate street houses Nos. 1 to 14	.....	2,569.95	2,569.95
For repairing and painting fence inclosing Quinta de los Molinos	.....	863.93	863.93
For fitting up building known as quartermaster's storeroom No. 6, for 3 laboratories	.....	15,064.19	15,064.19
For contingencies (advertisements, office supplies, etc.)	.....	245.00	245.00
For purchase of implements for Isle of Pines	.....	953.80	953.80
For Santiago School, preparing plans	.....	387.37	387.37
For construction of operating room and installing plumbing and electric-light plant at Mercedes Hospital	.....	5,893.95	5,893.95
For making all necessary arrangements to prevent serious deterioration of the property of the Habana Brick Company, and employment of necessary watchmen	.....	418.23	418.23
For street cleaning	460,924.00	111,980.76	572,904.76
For street cleaning repair shops	11,379.99	12,808.29	24,188.28
For street sprinkling	24,991.51	15,006.59	39,998.10
For Regla, street cleaning	16,727.86	2,862.13	19,589.99
For collection of refuse	173,597.49	67,245.27	240,842.76
For disposal of refuse, removal to sea	175,202.91	40,157.34	215,360.25
For disposal of refuse, cremation	58,255.07	3,898.96	62,154.03

[a] Expenditures under this head include incidental expenses and salaries of employees of chief engineer's office, record division, the voucher and pay roll divisions of the pay department, and property department. Two hundred and eighteen dollars and sixty-eight cents excess was, through error, shown in sixteen months' report as expended under this head. It should have gone to survey of fortifications, which is now charged with this amount.

[b] Much of the furniture and supplies purchased during 1899 under this head was for entire engineer department, including department of streets, department of street cleaning and parks, water and sewer department, department of renovation and sanitation of buildings, department of public works, and municipal architect's department.

[c] Four thousand four hundred and eighty-four dollars excess was, through error, shown in sixteen months' report as expended under this head. Should have gone to operation of dredging plant, which is now charged with this amount.

[d] Expenditures made from funds furnished by ayuntamiento.

[e] Of expenditures under this head $7,598.52 was from miscellaneous sources, consisting chiefly of fines and funds left in Bank of Spain by Spanish Government to the credit of works of the port. Four thousand seven hundred and two dollars and sixty-eight cents expended under employees and incidental expenses, administration, engineer department, and survey of fortifications in sixteen month's report, as shown on notes under these items, is now charged to this account.

[1, 2, 3, 4, 5, and 6] Expenditures under these heads were from funds furnished by the parties and firms mentioned in each instance.

Digitized by Google

Statement of expenditures from January 1, 1899, to December 1, 1900, of the engineer department, department (afterwards) city of Habana, etc.—Continued.

	Expended Jan. 1, 1899, to June 30, 1890.	Expended July 1 to Dec. 31, 1900.	Total.
For parks, preservation and care of	$59,224.97	$26,511.17	$85,736.14
For parks, watchmen, day and night	12,837.99	11,284.11	24,122.10
For city stables, stable No. 2	132,098.50	41,516.33	173,614.83
For city stables, stable No. 3	30,449.90	24,520.39	54,970.29
For Guanabacoa, sanitary cleaning and repairs to streets and roads	36,182.42	2,883.64	39,066.06
For construction of sea wall at La Punta		8,846.94	8,846.94
For grading and cleaning lots around old city wall		4,103.58	4,103.58
For extending sewer at north end of Tacon street		348.34	348.34
For purchase of 3 sprinkling wagons (special allotment)		1,500.00	1,500.00
For repairs to tug Narciso Deulofeu		4,263.07	4,263.07
For repairs to streets[a]	663,615.01	100,346.28	763,961.29
For stable No. 1 and Fosos shops	93,232.95	15,134.88	108,367.83
For Regla, street repairs		2,378.01	2,378.01
For Vento stone crushing plant and quarry	33,943.12	46,700.76	80,643.88
For survey for establishment of street grades	24,787.18	22,485.79	47,222.97
For asphalt block pavement for C. G. Mendoza and North American Trust Co.[1]	1,377.02		1,377.02
For asphalt block pavement in vicinity of custom-house, governor-general's palace, and supreme court building	33,478.31		33,478.31
For construction of bunks Fort Atarés[b]	367.60		367.60
For repairs to streets and changes of grades necessitated by the street railroad work		15,245.27	15,245.27
For repairs to streets (inspectors furnished Habana Electric Railway Co.)[2]		1,940.00	1,940.00
For brick paving through gateway to general wharves of Habana		321.54	321.54
For cross sectioning and profiling streets		1,562.65	1,562.65
Sewer department	175,650.40	41,226.63	216,877.03
For repairs to sewers at Reina Mercedes Hospital		1,787.39	1,787.39
For night-soil department (removal of night soil)	45,074.88	13,875.12	58,950.00
For electrozone plant	83,546.96	15,185.84	98,732.80
Water department[c]	200,900.72	44,523.62	245,424.34
For improvement of Albear Canal	2,795.44		2,795.44
For improvement of Almendares River and Aqueduct at Vento	21,161.26		21,161.26
For water main to Aldecoa Hospital, city farm, military hospital No. 1, and Mercedes Hospital [c]	9,799.22		9,799.22
For water supply to Casa Blanca, Morro, and Cabaña	42,240.00		42,240.00
For construction of fences at Vento and Palatino	88.17		88.17
For water supply to Regla an Luyanó	18,493.57	3.00	18,496.57
For removal and sanitation of buildings	2,078.10		2,078.10
For laying water pipe on Zequeira street, between Consejero, Arango, and Zarabia streets[b]		92.53	92.53
For maintenance of Palatino pumping station		7,353.53	7,353.53
For maintenance of Palatino and Zanja Real		4,518.25	4,518.25
For improvement of water supply to Quemados, Camp Columbia, and Principe	1,240.05	12,129.16	13,369.21
For installation of water pipe at Tamarindo Station[b]	104.11	345.68	449.79
For installation and removal of water meters for Habana Electric Railway Co.[b2]		49.58	49.58
For water department, work on account of Habana Electric Railway Co.[b2]		442.33	442.33
For installation of public fountain at Casa Blanca		230.44	230.44
For repairs to urinals at Olavarrieta School		11.74	11.74
For installation of water pipe at Tacon Market	372.67		372.67
For installation of 4-inch main on Thirteenth street, Vedado	603.87		603.87
Total	3,368,996.69	1,005,501.41	4,374,498.10

[a] Thirteen thousand five hundred and ten dollars excess was, through error, shown in last annual and sixteen months' reports as expended under this head. Of this sum $12,060 should have gone to stable No. 2 and $1,450 to disposal of refuse, removal to sea. These two items are now charged with the amounts named.

[b] Expenditures made from funds furnished by ayuntamiento.

[c] Four thousand dollars excess was, through error, shown in last annual report as expended under this head. Of this amount $2,728 was expended in April, 1900, and appeared as an excess in sixteen months' report. This whole should have gone to street sprinkling, which is now charged with same.

[1] and [2] Expenditures under these heads were from funds furnished by the parties and firms mentioned in each instance.

Digitized by Google

CALZADA DE JESUS DEL MONTE, SEPTEMBER 19, 1899.

CALZADA DE JESUS DEL MONTE, AFTER NEW TRACKS WERE LAID, JANUARY 1, 1901.

Digitized by Google

Digitized by Google

CALZADA DEL CERRO, AUGUST, 1899.

CALZADA DEL CERRO, AFTER NEW TRACKS WERE LAID, JANUARY, 1901.

Digitized by Google

Digitized by Google

TRACK LAYING, HABANA ELECTRIC RAILWAY COMPANY, CALZADA DEL CERRO.

TRACK LAYING, HABANA ELECTRIC RAILWAY COMPANY, PLAZA DE LUZA.

Digitized by Google

Digitized by Google

HABANA ELECTRIC RAILWAY COMPANY. POLE LOCATION ON WIDE STREETS.

HABANA ELECTRIC RAILWAY COMPANY. POLE LOCATION ON NARROW STREETS; TRUSSES NOT YET IN POSITION.

Digitized by Google

Digitized by Google

PROPERTY DEPARTMENT.

[Mr. Beauregard Weber, property clerk

The duties of this office are the purchasing of materials, tools, etc., used by the engineer department, and the storage and care of materials on hand.

During the period from July 1 to December 31 there have been received in this office 1,581 requisitions on which purchases have been made, each requisition usually divided between two or more firms, often 5 orders being issued on 1 requisition.

There have passed through this office bills amounting to $303,191.95, an average of $50,698.66 per month for the six months, and over $60,000 per month for the last four months, the purchases during July and August being light.

New forms and blanks for property accountability, required by the auditor for the island, were approved and went into use September 1, requiring much additional detail work and necessitating the employment of 2 more clerks to properly attend to these returns.

During September and November two inspections of property were had and a lot of tools, old iron, oxen, mules and horses were condemned by the inspector-general and ordered to be sold at public auction. There was realized from the sale $1,243, which was turned into the public treasury.

The business men and firms in Habana with whom this department does the most business are gradually becoming more Americanized in their methods, facilitating the transaction of business, and greatly reducing the cost of almost all classes of material, particularly building material, such at lumber, American brick, cement, hardware, etc.

All purchases are made in occordance with provisions contained in Order No. 249, headquarters Division of Cuba.

DEPARTMENT OF STREETS.

[Mr. W. N. McDonald, assistant engineer, superintendent.]

Owing to Mr. McDonald's illness, the department was under the charge of Mr. C. C. Fitz Gerald, assistant engineer, from July 1 to September 25, when Mr. Fitz Gerald resigned. From September 26 to December 15, on which date Mr. McDonald returned to duty, Mr. W. H. James, assistant engineer, was in charge.

While the work of the department was confined almost entirely to repairs and renewals, it was greatly increased by the work necessitated by the installation of the new street railway tracks. These tracks are installed in a substantial and permanent manner; and it was necessary that their grades should conform to the permanent street grades.

As mentioned in earlier reports, no comprehensive system of street grades was ever adopted for the city, but as each street was laid out or built upon the street was made in close conformity to the lay of the land, a noticeable exception being the Calzada Carlos III, for which a definite project was made and executed before the street was opened.

The building laws of the city provide that when changes in grade are made in streets property owners shall be reimbursed for damages caused by such changes, and many defects in grades are noticeable throughout the city on account of the law.

In preparing a comprehensive system of grades it has been necessary to make only such changes as caused no damage to adjacent property, or such as are absolutely necessary for drainage. Under this rule many slight changes were necessary, and the new tracks are laid in the proper lines.

As the entire city is shortly to be provided with new pavements it has not been economical or advantageous to make changes for the entire section of streets in advance, but only to the extent necessary to permit traffic.

The work of the department has kept well up with the work of the railway company; and the disturbance to city traffic, due to the very extensive work of the railway company, has been reduced to a minimum. At best, in the narrow streets, the disturbance to traffic has been considerable, and the citizens of Habana have borne this necessary annoyance with great patience.

Practically the only macadam renewal done has been on Calzadas del Cerro and Jesus del Monte. This was necessitated by the relaying of the tracks of the Havana Electric Railroad Company to permanent grades and making the changes in the old roadway to conform to the same. The only streets heretofore unpaved, but paved with macadam within the period covered by this report, are Velazquez from Cruz del Padre to Infanta and Cruz del Padre from Velazquez to Calzada del Cerro, which

Digitized by Google

work was necessary to afford a runaround while street-railroad work was in progress on the narrow portion of the Calzada del Cerro. One block was also paved with macadam on Santa Rosa, from Falgueras to Santa Catalina, which work was necessary for sanitary reasons.

The work on Calzada Jesus del Monte, in addition to the paving of a space of 5.33 meters in width with vitrified brick by the Havana Electric Railroad Company, consisted of vitrified clay pipe in the open sewers in such places as it was necessary in order to get a 3-meter roadway outside of the car track and renewing with macadam the whole of the street.

The work on Calzada del Cerro was of the same character, with the exception that the street was of sufficient width to avoid the necessity of replacing open sewers with clay pipe in order to get the required roadway. These two thoroughfares, the only ones leading out of Habana, have been brought to as satisfactory a condition as can be reached by the use of macadam.

Plates show these streets before and after the new tracks were laid.

The work done by the Havana Electric Railroad Company during this period has amounted to 15.2 linear miles of track laid, paved between the rails and a distance of one-half meter outside of same. This has been of enormous advantage to the city and to the public in general by making a good roadway on the streets that were either macadamized and maintained at a large expense or paved with granite block, which is very objectionable on account of its slipperiness and unevenness. The immediate saving per annum of maintenance on macadamized streets on which these tracks are laid will amount to a considerable sum, owing to the fact that probably 75 per cent of the traffic on these streets is over and on the pavement laid by this company.

Very little change has been made in the classification of paved and unpaved streets of Habana, table of which is included herewith. The large amount of macadam-renewal work done prior to July 1, 1900, will be of great advantage in determining the character of foundation and top metal to be used in that portion of the city lying west of the Prado when it is decided to lay modern pavements in the city, owing to the fact that the result of the traffic over different streets and the wear and tear to be provided for when modern pavement is laid can be more definitely decided upon than when the streets were in such condition that the wear and tear of the traffic could not be observed.

The total length and classification of streets in Habana on December 31, 1900, is as follows:

	Linear meters.	Linear miles.	Percentage.
Belgian block	38,968	24.24	21.66
Boston block	4,114	2.566	2.29
Asphalt block	1,094	.68	.61
Vitrified brick	497	.31	.28
Sheet asphalt	105	.06	.05
Cobble	333	.21	.19
Macadam	101,472	63.046	56.37
Wooden block	55	.03	.02
Unpaved	33,349	20.718	18.53
Total	180,007	111.86	100

The merit system, as described on page 30 of the last annual report, in appointing assistant foremen, foremen, and inspectors is still in force, but it must be confessed that the success met with in teaching this class how to handle labor and material has been rather disheartening. It seems almost impossible to instill into their minds the fact that the duties of a foreman comprise other things than merely drawing his salary. Men who have never done any of this class of work under the old régime have proven by far the better material for development, for the reason that they had no old ideas to forget and have been taught entirely by American engineers. At present and for some time past none of the engineers in active charge of work have required the use of an interpreter, and some of the best inspectors developed are young men who, when this work was first started, were interpreters to engineers in charge of same, and day after day had numerous object lessons in the proper handling of men and material, owing to their daily accompanying the engineers in charge of this work.

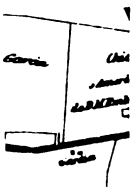
Plate herewith shows the work done on the streets during the six months ended December 31, 1900.

Modern paving.—Attention is invited to report on modern pavements on page 22 of the last annual report. The experience gained in the experiments with the

Digitized by Google

Digitized by Google

Digitized by Google



Mare

Digitized by Google

Digitized by Google

Digitized by Google

various classes of permanent pavements experimented upon has been of the greatest value. As anticipated it has been proved that asphalt pavements will not stand the wear in the warehouse district and in those places where from the presence of the street-railway track, or from other causes, vehicles must necessarily follow in the same lines. Attention is invited to the illustrations showing the wear of the asphalt-block pavement in Oficios street opposite the custom-house. Similar wear has taken place at the corner of Tacon and O'Reilly streets, where, owing to the break in the continuity of both of these streets, caused by the projection of the governor's palace, the wheels of the vehicles track in a space less than 1 meter in width and the traffic is very heavy.

Prior to laying the pavement on Oficios street, opposite the custom-house, the authorities were informed by the chief engineer that a pavement of this class could not be expected to stand the traffic of this street, and the pavement was laid with this understanding and under the consideration that it would be more economical to renew the pavement at comparatively short intervals than to have the work of the custom-house obstructed by the noise of the streets.

It is estimated that the life of asphalt block on these streets at the points named is two years.

Vitrified brick laid in the plaza of San Francisco has proven very satisfactory to the department and to the vehicle owners.

Nine makes of brick have been tested in this city up to date, and of these five have proved to be of the quality best suited to the conditions here.

The absence of a tire ordinance and the enormous loads placed in the carts make the wear on a few streets like Oficios extremely heavy. There is no doubt that nothing except the best quality of granite or iron will stand such wear for any prolonged period. Iron pavements are ruled out by their cost, and the first cost of granite pavement is two or three times that of brick, and it is noisy and in dry weather very slippery. Under these circumstances brick is more desirable, despite the known wear. A brick pavement can be repaired cheaply and easily. The tire ordinance, which goes into effect June 30, 1901, should also be a relief.

In this connection attention is called to the fact that this ordinance was passed in February, 1900, to take effect June 30, 1901, and on January 1, 1901, only 270 vehicles of all classes had been made to comply with this new law; and unless steps are taken to call attention generally to the existence of this ordinance and to impress upon the general public that it will be rigidly enforced from the date it goes into effect practically none of the vehicles in the city will have complied with the ordinance when it does go into effect. From the way in which this ordinance is looked upon by the vehicle-owning public it would seem that they do not expect the law to be enforced at the time it goes into effect, or that the time of putting it into effect will be postponed from time to time.

In the laying of brick, cement joints have not proved advantageous. The pavement provided with them is noisy and after about eighteen months the constant jarring disintegrates the mortar of the joints. In the Plaza San Francisco the joints were swept half full of sand and then poured full of No. 6 coal-tar distillate and sand immediately thrown over the entire surface. The pitch must be heated in a closed vessel to obtain the proper temperature, and it is essential also that the surface sand be thrown on at once before the pitch, which is left on top of the bricks, is cool. With these pitch joints no special expansion joints are needed. The pavement is rendered much less noisy and the pitch and sand left on the surface protects the edges of the bricks until they are fully set. The use of a pitch joint also allows the opening of a street for traffic within a half hour after same has been completed, while the use of a cement joint requires that the street be kept closed three or four days after completion, in order to permit the cement grout to take a set. The film of pitch left on top of the pavement after grouting the joints has a surprising durability. Where sand enough has been applied it is not slippery. No trouble has been experienced from the pitch running during the hot weather. The advantages of this film in this climate have proved so great it now seems that it would be economical and advantageous to renew it when worn out, which experience has shown is in about one year. Experiments as to this are about to be made. The first cost of mortar joints and of the pitch joints are practically the same.

Of the various classes of foundations experimented with that formed by lowering the old pavement, as described on page 23 of the last annual report, has proved the least satisfactory. Apparently it was impossible to make a smooth stable and cushion over it, owing to the irregular top surface of the block. The surface of the pavement now shows unsightly waves, apparently due to an irregular foundation, which will certainly impair the durability of the blocks forming the surface. The thin foundation laid in Chacon street shows no signs of settlement.

Digitized by Google

Sheet-asphalt paving laid in June, 1899, by the Barber Asphalt Company has not proven satisfactory. It is thought, however, that this pavement has not had the proper test. Owing to the small amount laid it was not thought advisable by the Barber Asphalt people to prepare their mixture in this city, but it was prepared in New York, brought here, reheated, and then laid on the streets. The amount of water that has passed over it, due to surface drainage, has kept the line of greatest traffic over this pavement wet a great deal of the time. The known effect of water on asphalt paving will explain to a great extent the cause of failure in a number of places in the pavement. The majority of patches put in this pavement since it was laid have been in the line of greatest flow of the water which has passed over the pavement. The asphalt pavements laid by the same company in Santiago de Cuba have proved entirely satisfactory. The materials for that were prepared and mixed in that city and the test there confirms the judgment expressed above.

Habana Electric Railroad Company.—The work to be done by this company is being rapidly carried on. Inspectors attached to this department and paid by the Habana Electric Railroad Company were placed over this work as it progressed. It is the duty of these inspectors to see that the pavement put in by the Habana Electric Railroad Company is laid in accordance with their permit; that traffic is not unduly obstructed; that crossings are kept on all work and that the general public is inconvenienced as little as possible. These inspectors are also charged with seeing that all excavations and excavated material are properly disinfected with the disinfectants required by the department. A great deal of trouble was caused by the unwillingness on the part of the Habana Electric Railroad Company to take into consideration any fact or item which did not enter into the actual requirements of the work as looked upon from their point of view. In many instances the police were resorted to and foremen were arrested and taken to the police station and fined, thereby reaching the company indirectly by stopping the work while the foreman was obtaining his release and paying the fine assessed upon him out of his own pocket. The employees of this company throughout the course of the work have failed to show a proper forethought and foresight necessary to avoid inconveniencing the general public as little as possible.

In their pole locations, where pipe poles and trusses have been used, which was on the narrow streets in the old part of the city, it is thought that the solution of the pole question, as it applies to Habana, has reached as nearly as possible an ideal point as regards other than an underground system. It is regretted that the necessary legislation was not made to permit the poles to be placed against the houses, thereby avoiding in a measure the disfigurement of the streets and the obstruction of the narrow sidewalks, according to the original design of this office.

On the streets where the poles were used without trusses, they were set, where possible, in the curb, when the sidewalk was of sufficient width to admit of same. In many instances these poles were set outside of the curb, 10 or 12 inches in the sidewalk from the face of the curb, or in the center of the sidewalk, due to the existence of sewers running parallel with the center line of the street but under the sidewalk.

Should a modern system of sewerage and paving be put in by the city, all poles other than those against the houses should be made to conform to the new conditions.

The engineers in the employ of this department were required to see that the tracks as laid by the Habana Electric Railroad Company conformed with the alignment and grades as given and approved by this office. All tracks have been laid to such grades and alignment as should be required were the city to pave the streets with modern pavement and sidewalks. The rapidity with which this work has been carried on by the Habana Electric Railroad Company has caused an unusual amount of hard work to fall upon some of the employees of this department, and great credit is due to Assistant Engineers W. H. James, F. Bonstedt, and R. D. Martin for their energy and faithfulness in the conduct of this work.

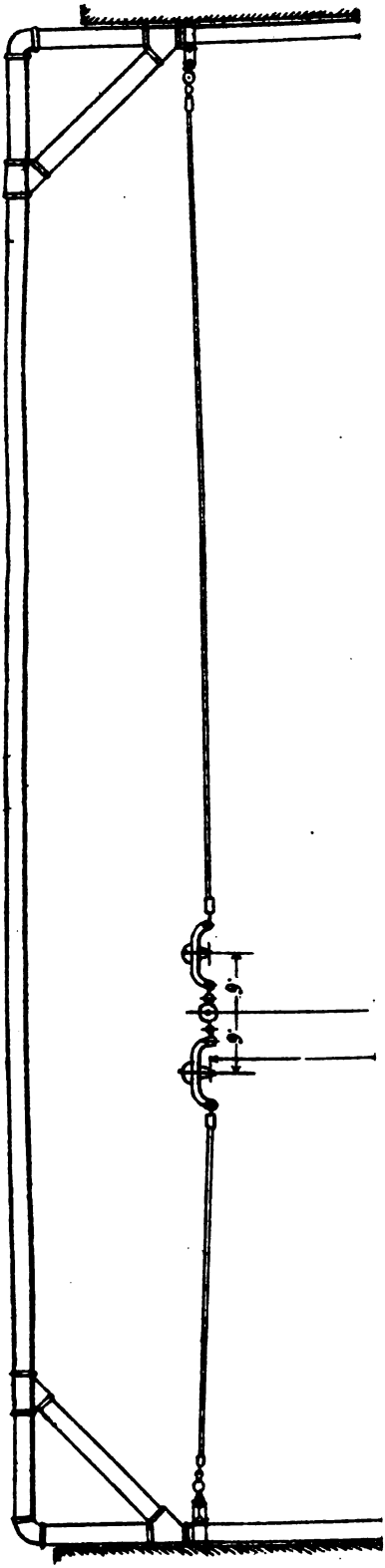
The linear miles of streets to be occupied by the Habana Electric Railroad Company amount to approximately 24.18. This work is classified as follows:

	Miles.
Streets occupied and completed on December 31, on which tracks 75 per cent of the vehicular traffic over these streets will travel	15.02
Streets to be occupied by tracks and remaining to be completed on which 75 per cent of the vehicular traffic will pass after completion	1.04
Track completed over which there can be no vehicular traffic	3.34
Track to be completed over which there can be no vehicular traffic	1.58

Habana street work.

The regular work of care and maintenance of streets and roads of the city is divided into the following classes: Block paving, bridges and masonry, sidewalks and curb-

Digitized by Google



Digitized by Google

Digitized by Google

ing, and macadamizing, and the following tables show in detail the force employed, carts used, material used, and work done. Unit cost of the different classes of work done will be found under recapitulation of work done.

BLOCK PAVING.

Average force daily employed:		
Inspectors		0.84
Subinspectors		.04
Foremen		2.40
Assistant foremen		2.38
Masons		1.05
Pavers		22.49
Carpenters		0.80
Laborers		17.17
Stonecutters		1.90
Blacksmiths		.81
Watchmen		1.72
Total average force daily employed		51.60
Average cost of daily force employed		$84.69
Unit cost per man per day		$1.69
Hired carts, average number used daily		3.38
City carts, average number used daily		2.88
Total carts, average number used daily		6.26
Average cost of daily carts employed		$14.17
Unit cost per cart per day		$2.26
Material used:		
Sand	cubic meters	558.85
Screenings	do	106
Brick (paving)		23,857
Cement	barrels	24.5
Small stone	cubic meters	24.5
Tar	barrels	1.35
Lime	do	.42
Asphalt block		2,056
Work done:		
Granite block relaid	square meters	3,516
Granite block repaired	do	25,056
Vitrified brick laid	do	345
Vitrified brick repaired	do	42
Asphalt blocks laid	do	49
Asphalt blocks repaired	do	51

BRIDGES AND MASONRY.

Average force daily employed:		
Inspectors		0.67
Foremen		.32
Assistant foremen		.67
Masons		1.10
Carpenters		1.36
Laborers		5.82
Watchmen		.50
Total average daily force employed		10.44
Average cost of daily force employed		$17.74
Unit cost per man per day		$1.69
Hired carts, average number used daily		1.29
Average cost of carts used daily		$3.67
Material used:		
Lumber	feet B. M.	19,451
Nails	pounds	644
Cement	barrels	217.50
Sand	cubic meters	38
Small stone	do	110.50
Large stone	do	44
Vitrified pipe	feet	1,048
Brick (common)		3,350
Lime	barrels	43
Screenings	cubic meters	37
Work done:		
Bridge, flooring, and arches repairs	square meters	836.46
Ditches constructed	linear meters	524.40
Ditches cleaned	do	1,315
Sewer pipe laid	do	211.50

Digitized by Google

SIDEWALKS AND CURBING.

This work has consisted entirely of keeping in repair the existing sidewalks and curbs. Old curbing and flagging has been picked up in places where it was not needed, and redressed and is kept in stock for making repairs throughout the city. No new curbing or flagging has been purchased by the department.

Average force daily employed:		
Foremen		0.04
Assistant foremen		.08
Masons		.04
Pavers		.10
Laborers		.44
Total average force daily employed		.65
Daily average cost of force employed		$0.64
Unit cost per man per day		$0.98
Hired carts, average number used daily		0.56
Average cost of carts used daily		$1.31
Unit cost per cart per day		$2.29
Material used:		
Sand	cubic meters..	6.68
Cement	barrels..	4
Lime	do....	4
Small stone	cubic meters..	.50
Work done:		
Sidewalk relaid	square meters..	132
Curb reset	linear meters..	156.50

MACADAMIZING.

Average force daily employed:		
Inspectors		2.82
Foremen		8.31
Assistant foremen		8.33
Engine drivers		3.06
Firemen		3.06
Laborers		107.20
Watchmen		5.05
Carpenter		.14
Pavers		.91
Oxmen		2.63
Masons		.11
Total average daily force employed		141.66
Daily average cost of force employed		$210.66
Unit cost per man per day		$1.48
City carts, average number used daily		4.35
Hired carts, average number used daily		13.39
Total carts, average number used daily		17.74
Ox rollers, average number used daily		0.56
Steam rollers, average number used daily		2.44
Average cost of carts used daily		$45.95
Unit cost per cart per day		$2.58
Material used:		
Large stone	cubic meters..	3,957
Small stone	do....	13,896
Screenings	do....	3,695
Work done:		
Macadam renewal	square meters..	64,780
Repairs	do....	179,256
Old stone removed	do....	26,355.50
Surfacing*	do....	14,159

Repairs to the streets and changes of grades necessitated by the laying of tracks by the Habana Electric Railway Company.—Commencing in August a special monthly allotment was made to carry on this work, previous to which date it was paid for from the regular allotments for street repair. Separate account of work done and cost thereof has been kept only since October, and the following tables of data only cover the period from October 1 to December 31, 1900.

* Consists of surfacing with earth and stone excavated by street railway company, and was used on the less important streets upon which there is a light traffic.

Digitized by Google

The work was divided into classes the same as the regular street work and the amount done is included in the recapitulation of the work done, and consists of restoring streets to their former condition, and in some instances in placing streets which were in poor repair in good general condition and bringing the grade of the streets up to the new grade established for the railroad work.

BLOCK PAVING.

Average force employed daily:		
Inspector		0.17
Foremen		2.16
Assistant foremen		2.19
Masons		1.08
Stonecutters		.33
Pavers		30.33
Blacksmith		.16
Laborers		31.64
Carpenters		.16
Total average force employed daily		68.22
Average cost of daily force employed		$101.67
Unit cost per man per day		$1.49
Hired carts, average number used daily		5.81
City carts, average number used daily		1.47
Total carts, average number used daily		7.28
Average cost of carts used daily		$21.17
Unit cost per cart per day		$2.79
Material used:		
Screenings	cubic meters..	178.90
Sand		251.75
Work done: Block paving repaired	square meters..	150.26

MACADAMIZING.

Average force employed daily:		
Foremen		1.70
Assistant foremen		1.83
Engine drivers		1.16
Firemen		1.16
Laborers		27.88
Watchmen		.87
Total average force daily employed		34.60
Average cost of force employed daily		$54.67
Unit cost per man per day		$1.65
City carts, average number used daily		0.67
Water carts, average number used daily		1.09
Hired carts, average number used daily		3.31
Total		5.07
Average cost of carts daily employed		$14.34
Unit cost of cart per day		$2.83
Material used:		
Large stone	cubic meters..	984
Small stone	do....	1,908
Screenings	do....	347
Work done:		
Macadam repairs	square meters..	24,614
Old stone removed	do....	1,456.47

Fosos repair shops.—These shops are located within the inclosure known as "Los Fosos," a description of which is given on page 29 of the last annual report.

While the shops are directly under the supervision of the street department, they are maintained for the repair of all property of the engineer department, with the exception of the subdepartment of street cleaning and parks, and the several branches of the municipal government.

Digitized by Google

Detailed statement of distribution of cost of work done at Fosos for six months ending December 31, 1900.

	Administration.	Streets.	Water and sewer.	Street cleaning and parks.	Renovation of buildings.	Fortification survey.	Ayuntamiento.
Carriages	$237.85	$457.94	$420.14	.....	$83.29	$97.36	$187.27
Wagons	.....	.....	68.80	.....	.....	.....	62.56
Carts	.....	288.99	.....	.....	.....	.....	.....
Sprinkling carts	.....	204.36	.....	.....	.....	.....	.....
Ambulances	.....	.....	.....	.....	.....	.....	368.19
Steam rollers	.....	483.59	.....	.....	.....	.....	.....
Meat wagons	.....	.....	.....	.....	.....	.....	84.01
Wheelbarrows	.....	.....	7.86	.....	.....	.....	17.88
Harness	.75	14.15	.....	.....	.....	.....	.....
Drawing tables made	.....	57.57	353.47	$37.37	.....	.....	.....
File cases made	.....	235.65	277.95	.....	.....	.....	.....
Repairs on buildings	.....	193.85	.....	.....	.....	.....	.....
Tools	.....	232.86	269.02	.....	.....	40.50	8.93
Machine	.....	194.92	10.52	.....	.....	.....	31.46
Signs painted	.....	.....	20.91	.....	.....	.....	.....
Sewer grates	.....	.....	332.88	.....	.....	.....	.....
Total	238.60	2,363.88	1,761.55	37.37	83.29	137.86	710.30

	Fire.	Police.	Sanitary.	Charities and hospitals.	Quartermaster.	Total.
Carriages	.....	.....	$196.17	.....	.....	$1,680.02
Wagons	$476.29	.....	.....	$59.16	.....	666.81
Carts	.....	.....	.....	.....	.....	288.99
Sprinkling carts	.....	.....	290.02	.....	.....	494.38
Ambulances	.....	$340.05	153.74	77.18	.....	939.16
Fire engines	190.87	.....	.....	.....	.....	190.87
Hook and ladder truck	57.00	.....	.....	.....	.....	57.00
Hose reel	254.22	.....	.....	.....	.....	254.22
Patrol wagon	.....	4.97	.....	.....	.....	4.97
Steam rollers	.....	.....	.....	.....	.....	483.59
Meat wagons	.....	.....	.....	.....	.....	84.01
Wheelbarrows	.....	.....	.....	.....	.....	25.74
Harness	.....	.....	.....	.....	.....	14.90
Drawing tables made	.....	.....	.....	.....	.....	448.41
File cases made	.....	.....	.....	.....	.....	513.60
Repairs on building	.....	.....	.....	.....	.....	193.85
Guaguas	.....	.....	.....	.....	$33.03	33.03
Tools	.....	.....	.....	.....	.....	551.31
Machine	.....	.....	.....	.....	.....	236.90
Signs painted	40.00	.....	.....	.....	.....	60.91
Sewer grates	.....	.....	.....	.....	.....	332.88
Total	1,018.38	345.02	639.93	136.34	33.03	7,505.55

When work is desired by any of the subdepartments request is made direct to the superintendent of the street department, and when desired by any of the branches of the municipal government the request is made to the chief engineer of the city.

The permit system is in use and careful account is kept of all material and labor used upon each piece of work, and statement is rendered when the work is completed of the exact cost thereof.

The following tables show the force employed, cost per day, and division and class of work performed for different departments during the six months:

Average force employed daily:	
Superintendent	1
Clerk	1.83
Carpenter	5.20
Apprentices	.59
Blacksmith	9.12
Apprentice	.36
Harness maker	1
Painter	1.88
Laborer	2.17
Watchman	.80
Total average force employed	23.95
Average cost of force employed daily	$52.35
Unit cost per man per day	$2.18

Digitized by Google

Regla street repairs.

Regla is a separate municipality situated on the opposite side of the bay from Habana.

The work of repairing and maintaining the streets of Regla was placed under the department in the latter part of September.

All of the improved streets in Regla are macadam, and as a rule are in miserable condition. Marti, the main street of the town, has been renewed or repaired throughout its entire length.

The stone used in Regla is obtained from a quarry on the edge of the town and is of a fair quality, and although not as good as Vento stone is of sufficient hardness to withstand the traffic passing over it. Two thousand three hundred and forty-five cubic meters of stone have been quarried and placed on the streets at a cost of 96 cents a cubic meter; the low cost is due to the favorable location of the quarry and the short haul necessary.

The following tables show the force employed, material used, and work done:

Average force employed daily:	
Foremen	0.85
Assistant foremen	.83
Laborers	20.96
Drillers	1.67
Assistant drillers	1.67
Watchman	.87
Engine driver	.85
Firemen	.85
Total average daily force employed	28.55
Average cost of daily force employed	$24.88
Unit cost per man per day	$0.87
Hired carts, average number used daily	4.84
Water carts, average number used daily	.79
Total carts, average number used daily	5.63
Steam roller, average number daily	1.56
Average cost of carts used daily	$15.96
Unit cost per cart per day	$2.83
Material used:	
Large stone, cubic meters	30
Small stone, cubic meters	1,545
Screenings, cubic meters	101
Work done:	
Macadam renewal, square meters	7,902
Old stone removed, cubic meters	115

RECAPITULATION.

Table showing the entire work accomplished by the street department during the period from July 1 to December 31, 1900, together with statement of unit cost of each class of work.

Daily average force employed:	
Paving and repair—	
Block paving	51.60
Bridges and masonry	10.44
Sidewalks and curbing	.65
Macadamizing	141.66
Total average force employed	204.35
Average cost of force employed	$313.67
Unit cost per man per day	$1.54
Hired carts, average number used daily	18.626
City carts, average number used daily	4.25
Water carts, average number used daily	2.98
Total	25.856
Ox rollers, average number used daily	0.56
Steam rollers, average number used daily	2.44
Daily average cost of carts employed	$65.08
Unit cost per cart per day	$2.52
Average cost of running steam rollers per day	$9.84
Average cost of rolling per square meter	$0.02

Digitized by Google

Average cost of running steam roller from July 1, 1900, to December 31, 1900, per hour:

Coal	$0.33
Oil	.02
Water	.01
Repairs	.23
Firemen	.14
Engine driver	.25
Water cart for roller	.25
Total	1.23

Total material used:

Large stone	cubic meters..	5,015
Small stone	do.....	19,484.50
Screenings	do.....	4,464.90
Sand	do.....	855.28
Cement	barrels..	246
Lumber	feet B. M..	19,451
Nails	pounds..	644
Bricks, common		3,350
Tar	barrels..	13.50
Lime	do.....	89
Sewer pipe	linear feet..	1,048
Asphalt blocks		2,056
Paving bricks		23,857

Total work done.

	Quantity.	Cost.			Cost per square meter.
		Labor.	Material.	Total.	
Granite paving, relaid in place	3,516 square meters..	$2,009.68	$381.20	$2,390.88	$0.68
Granite block paving, repairs	40,082 do....	20,457.24	2,389.40	22,846.64	.57
Brick, new	345 do....	727.42	1,059.68	1,787.10	5.18
Brick, repairs	42 do....	17.54	42.10	59.64	1.42
Asphalt block, new	49 do....	29.85	158.80	188.65	3.85
Asphalt block, repairs	51 do....	13.51	53.30	66.81	1.31
Bridges	836.46 do....	1,495.15	1,984.52	3,479.67	4.16
Ditches cleaned	1,315 lineal meters..	144.65		144.65	[b].11
Sewer pipe laid [a]	211.50 do....	659.80	184.20	844.00	[b]4.00
Sidewalks relaid	132 square meters..	37.28	28.72	66.00	.50
Curb reset	156.5 lineal meters..	38.05	4.25	42.30	[b].27
Macadam renewal	64,780 square meters..	22,885.69	21,164.71	44,050.40	.68
Macadam repairs	203,870.50 do....	34,698.28	36,656.40	71,354.68	.35
Filling	23,917 do....	1,435.02		1,435.02	.06

[a] The pipe used in this work was not purchased during the six months, it being stock remaining on hand from previous period. The cost thereof is, however, indicated in statement of cost.
[b] Cost per lineal meter.

VENTO STONE PLANT.

[Mr. A. S. Carswell, assistant engineer, in charge.]

Further efforts have been made to improve the quality of stone used in macadam work and to decrease its cost. The cost of stone from this quarry delivered in the streets during the month of January, 1901, was $2.20 per cubic meter. The cost of stone from other sources, but not of equal quality, was $2.01 per cubic meter. There can be no doubt that the establishment of this quarry has decreased the cost of stone from private quarries.

The cost of the Vento stone has been enhanced by the railway freight charges and by the irregularity of the deposit of the hard stone; also by the fact that eight hours is a day's work for employees of the engineer department, but private parties work the same class of labor at the same pay ten or twelve hours. It is possible that later, when there is sure competition between private quarries and a certainty of the possibility of securing private stone in ample quantities, it may be advisable to discontinue operations at this quarry as long as the price of macadam stone remains reasonable.

Efforts are made from time to time to obtain a quantity of first-class macadam trap rock from the States at a reasonable cost. In November an order was given for 1,000 tons of trap rock from New York, to be delivered f. o. b. wharf Habana for $2.95 per net ton. For some reason the firm to whom the order was given (at their own figures, they being the lowest bidder) refused to fill it.

Now the old paving stones taken up by the Habana Electric Railroad Company from the portion of the streets originally paved by them have become available, and

Digitized by Google

they will be broken into macadam sizes and delivered at $2 per cubic meter, thereby giving a good supply of the best quality of trap, rock macadam, with which it is proposed to make the permanent roadway of the Vedado road and of the Calzada de la Infanta.

When the remainder of the old stone pavements of the city are removed, there will be an abundant supply of good macadam stone for the streets which are to be paved or repaved with that class of pavement. It is probable that when this stone becomes available it will be more economical to move the Vento crusher to Habana, in order to use it in crushing this stone.

The accompanying table, showing the distribution of the different costs entering into the total cost of macadam stone from this plant, delivered in the streets of Habana, is included herewith. This data is self-explanatory, with the exception probably of the increase of cost of stone for the month of September over that of the preceding month. This was due to the fact that the greater part of the stone from Vento during the month was used in renewing Calzada Jesus del Monte on account of the street-railway work, thereby causing an extremely long haul from the cars to the point needed; also to the increase of the amount expended on the permanent plant during that month.

Detail cost of Vento stone.

Month.	Permanent plant.	Operating crusher and quarry.	Cleaning and disinfecting quarters.	Superintendence.	Total cost of operations.	Output, cubic meters.
July	$885.72	$3,126.89	$35.00	$313.67	$4,361.28	2,073.04
August	181.29	3,615.71	30.00	337.00	4,174.00	3,297.31
September	463.75	3,299,33	40.00	337.00	4,140.08	2,658.40
October	375.65	4,104.46	107.15	327.00	4,914.26	3,460.07
November	379.67	3,215.69	37.86	327.00	3,960.22	2,923.86
December	104.16	3,540.25	79.71	327.00	4,051.12	3,915.44

Month.	Cost per cubic meter loaded on cars at crusher.	Rent of quarry.	Freight on stone to Habana.	Cartage from cars to streets of Habana.	Total cost per cubic meter after loading on cars.	Total cost per cubic meter delivered the streets of Habana.
July	$2.10	$450	$1,282.57	$1,582.55	$1.55	$3.65
August	1.26	450	1,801.10	2,652.37	1.48	2.74
September	1.55	450	1,660.76	2,463.36	1.71	3.26
October	1.42	450	1,860.90	2,048.03	1.26	2.68
November	1.35	450	1,649.20	1,676.73	1.27	2.62
December	1.03	450	2,183.89	2,106.57	1.19	2.22

The cost of inspecting Vento stone is $0.06 per cubic meter. The cost of inspecting contract stone is $0.11 per cubic meter.

The effect of this plant on the market price of stone and the saving effected and to be effected by the erection thereof, will, by the time the new paving system of Habana is installed, have paid all costs entering into the cost and maintenance of the plant.

Cuban labor only is employed at this place, with the exception of the engineer in charge, and the timekeeper. Every item of expense is carefully watched by Mr. Carswell and his every effort is concentrated in the attempt to reduce the cost of stone to the city.

Average force employed and cost per day at plant:	
Assistant engineer	$1.00
Clerk	1.00
Blacksmith	.50
Storekeeper	.04
Engine driver	.50
Telegraph operator	.50
Foremen	2.39
Carpenter	.15
Mason	.08
Drillers	2.01
Firemen	$0.49
Hoist man	.26
Carmen	.25
Track man	.17
Watchmen	1.42
Pump man	.30
Laborers	76.45
Total average force daily employed.	87.46
Average cost of daily force employed	110.74
Unit cost per man per day	1.26

The cost of operating and all other expenses incidental to the operation of the plant have been included in the cost per square meter of work done on the streets of Habana.

Digitized by Google

Survey for the establishment of street grades.—Attention is invited to report on this matter in last annual report on page 28.

This work is now under the charge of Mr. E. W. Ritchie, assistant engineer, with Mr. George LeGuern as chief draftsman.

On July 1 there were six parties in the field engaged in the field work necessary for these maps. At present there is one small party in the field used to pick up doubtful points in the notes of the previous work. Ninety-five per cent of the field work has been completed, and all that is necessary for a modern system of pavements has been practically done with the exception of plotting a portion of the notes. Sixty-five per cent of the field work has been plotted. A detailed statement of the work under this heading is given.

Average force daily employed:		
Engineers		$7.80
Draftsmen		13.66
Transitmen		2.80
Chainmen		10.55
Rodmen		9.97
Computer		1.00
Messenger		.20
Total average force daily employed		45.98
Average cost of force daily employed		114.81
Unit cost per man per day		2.50
Field work:		
Survey of streets and Government property	kilometers	77
Lines rerun	do	19
Stadia surveys	do	54
Base line, 1:230 meters long closing 1:250,000.		
Triangulation—		
10 stations occupied primary.		
17 stations observed primary.		
20 stations occupied secondary.		
20 stations observed secondary.		
Office work:		
Traverse maps 1:1,000—		
Plotted	do	55
Traced	do	113
Special maps 1:1,000 (Cerro)	do	8
Special maps 1:2,000 (Vedado)	do	22
Special maps 1:5,000 (Vedado)	do	22
Block maps 1:250—		
Plotted	maps	619
Checked	do	442
Duplicated	do	118
Street squares 1:250 plotted	do	10
Maps for car lines, 1:250 plotted and traced	kilometers	26
Consolidated map of Habana 1:5,000	do	43
Map of Habana, 1854, traced.		
Computation of areas for proposed paving and sewering of Habana.		
Computation of surveys, 75 per cent of work done.		
Vandyke and blue prints, 2,844.		
Levels taken:		
Field work—		
Streets run	do	131
Office work—		
Profiles plotted	do	45

DEPARTMENT OF STREET CLEANING AND PARKS.

[Mr. A. C. Harper, assistant engineer, superintendent.]

Since the last annual report made by this department, no material change has been made in the general organization. The subdepartments remain the same, except that the subdepartment of surveys has been abolished.

A number of special projects have formed a part of the work of this department during the period covered by this report, some of which have been completed. A statement of the conditions necessitating these improvements, together with a full report of work done and cost of same, appear in the body of this report under separate headings.

ORGANIZATION OF THE DEPARTMENT.

This department is divided into the following subdepartments, under which headings reports are made: Street cleaning, street sprinkling, collection of refuse, disposal of refuse, care and preservation of parks, special service, department stable No. 2, department stable No. 3, street-cleaning repair shops.

Digitized by Google

The work of street cleaning is superintended by three general inspectors, Messrs. C. Aguirre, M. Saumell, and F. Steinbuch, two on day and one on night duty.

The work of collection and disposal of refuse is under the charge of Mr. J. W. Paine, superintendent, and to his good management the reduction in the cost of collection is largely due.

The work of care and preservation of parks is under the charge of Mr. J. W. Pierce, assistant engineer, superintendent, to whose able and earnest assistance are due the most of the improvements made in the parks during the period covered by this report, and the satisfactory conduct of the engineering features of the work generally, of the department of street cleaning and parks.

The subdepartment of special service is under the charge of Mr. C. Echarte, superintendent, to whom the department is indebted for the discipline of the watchmen and guard service and the efficient manner in which he has discharged the many and trying duties of his position.

The work of transportation is in charge of Mr. E. C. Harrington, superintendent. It comprises department stables Nos. 2 and 3, and street sprinkling. There is no branch of the work in the department of street cleaning and parks which has so many annoying details, and Mr. Harrington deserves a great deal of credit for the manner in which he has dealt with them.

On October 15, 1900, Mr. T. Warren Allen reported for duty as a general assistant engineer. On November 12 he was forced to assume entire charge of the department, owing to the illness, with yellow fever, of the superintendent. The masterly manner in which he assumed and discharged the manifold duties of a department of the size and character of this, on such short notice, mark him as a man of exceptional ability. His subsequent able and untiring assistance in the work generally, and especially where engineering skill has been required, have been of great value to the department.

Street cleaning.—This branch of the work has become so well systematized that the same amount of work is now being done at less cost than formerly, although the average of wages paid daily to each employee is higher, due to the fact that most of the men have been with the department on a gradually increasing scale of wages for time service more than a year.

Where the traffic is heavy, about one-third of the area cleaned in the city districts (an average of 588,857 square meters) is cleaned twice daily.

No change has been made in the division of the streets with reference to districts during the period covered by this report, the same being shown on plate accompanying report for fiscal year ending June 30, 1900.

The area of streets cleaned in the city and suburban districts is shown by the following tables:

City districts:	Square meters.
Asphalt street pavement	1,215
Asphalt block pavement	7,764
Belgian block pavement	361,476
Boston block pavement	42,731
Macadam pavement	765,326
Brick pavement	5,629
Wood pavement	1,740
Cobble pavement	6,195
Unpaved	29,484
Total	1,221,560

Suburban districts.—Under this head are included the following: Jesus del Monte, Cerro, Nedado, Ceiba, Puentes Grandes, Arroyo Apolo, and Arroyo Naranjo.

In the last annual report the last four were reported upon under the heading "neighboring villages." They are now included in "suburban districts," as the unit costs in all are practically the same.

	Square meters.
Boston block pavement	73,722
Brick pavement	273
Macadam pavement	300,969
Unpaved	267,245
Total	642,209
Casa Blanca: Unpaved	30,186
Regla:	
Unpaved	100,698
Cobble pavement	6,573
Total	779,666

Digitized by Google

The organization of the department of street cleaning, by months, for the six months ending December 31, 1900, is as follows:

Months.	Superintendent.	Office.	Inspectors.	Subinspectors.	Foremen.	Sweepers.	Water boys.	Average number persons employed per day, shown by months.
1900								
July	1	3	3	12	49	489	36	493
August	1	3	5	11	51	373	37	481
General inspection.								
September	3	3	9	11	48	335	43	449
October	3	3	5	10	48	332	41	441
November	3	3	4	10	48	348	42	458
December	3	3	4	10	46	341	42	449
Average	2.3	3	5	10	48	353	40	461

This shows a decrease of 51 in the total average number of daily employees from that shown for the preceding twelve months.

The following consolidated table shows the amount and cost of street cleaning in city districts 1, 2, 3, and 4, suburban districts 5, 6, and 7; Casa Blanca, 8, and Regla, 9:

Districts.	Cleaned daily.	Force employed.		Cost per 1,000 square meters.				Total.
		Number of sweepers employed.	Average cleaned per day per man.	Sweepers.	Carting.	Superintendence.	Office expenses.	
	Sq. meters.		*Sq. meters.*					
City districts 1, 2, 3, and 4	1,810,417	214	8,459	$0.136	$0.025	$0.056	$0.002	$0.219
Suburban districts 5, 6, and 7	595,182	112	5,734	.217	.041	.073	.003	.334
Regla	107,271	17	6,310	.1095	.018	.031	.0015	.16
Casa Blanca	30,186	10	3,018	.358	.02	.097	.005	.47

The cost of street cleaning in Casa Blanca has been very materially reduced during the past six months, but is still in excess of the cost in other districts, and is caused by the poor construction of the town and the absence of graded streets.

The high rate of cost per 1,000 square meters in districts Nos. 5, 6, and 7 is due to the fact that the work is scattered over a large area, thereby increasing the cost of inspection.

Street cleaning by districts.

District No.	Cleaned daily.	Force employed.		Cost per 1,000 square meters.				Total.
		Number of sweepers employed.	Average cleaned per day per man.	Sweepers.	Carting.	Superintendence.	Office expenses.	
	Sq. meters.		*Sq. meters.*					
1	397,196	70	5,674	$0.21	$0.03	$0.084	$0.002	$0.326
2	493,528	61	8,090	.14	.026	.062	.002	.23
3	564,977	46	12,282	.09	.02	.0415	.0015	.153
4	355,716	37	9,614	.12	.021	.05	.002	.193
5	124,654	25	4,986	.23	.05	.077	.003	.36
6	291,900	53	5,508	.21	.04	.07	.003	.323
7	178,628	34	5,254	.22	.04	.076	.003	.339
8	30,186	10	3,018	.348	.02	.097	.005	.47
9	107,271	17	6,310	.1095	.018	.031	.0015	.16

The average cost of street cleaning per 1,000 square meters for the six months ending December 31, 1900, is shown by the following table:

Sweeping	$0.18
Carting	.02
Superintendence	.057
Office expenses	.003
Total per 1,000 square meters	.26

Digitized by Google

The total number of cart loads of street sweepings, and the equivalent number of tons, removed from the different districts for the six months ending December 31, 1900, are shown by the following table:

	Cart loads.	Tons.
City districts	16,440	8,830
Suburban	10,371	5,776
Regla	621	465
Casa Blanca	439	327
Total	27,871	15,398
Average per month	4,645.1	2,566.3

Street sprinkling.—This department of the work of keeping the streets of the city in a sanitary condition has been greatly improved, and its utility materially increased during the six months ending December 31, 1900.

Three new sprinkler wagons of 750 gallons capacity each, of the Austin-Western type, delivered early in July, 1900, have been added to the service, making a total of 16 now in use. Two electrozone tanks of 200 gallons capacity each have been constructed and mounted on old cart trucks for use in distributing electrozone in small quantities to parts of the city where its use is necessary for purposes of disinfection. These carts have relieved the electrozone sprinklers of most of the work of distribution, thus materially increasing the facilities of the sprinkling service.

All of the macadam streets of the city and the principal ones of the suburbs are sprinkled with water daily. Where there is need of it on account of heavy traffic, they are sprinkled two, three, or four times, as the occasion requires, except when rain makes it unnecessary.

All the streets of the old part of the city lying east of and including Cuba street are sprinkled once daily with electrozone.

An average of about 79 animals are used in this subdepartment daily. The force employed, cost of labor and work done, are shown in accompanying tables.

Street sprinkling with water:	
Force employed, daily average, July 1 to December 31, 1900—	
Inspectors	3
Drivers	18
Assistant drivers	18
Animals	62
Wagons	11
Area of street sprinkled—	
Daily average ..... square meters..	933,900
Total per month ..... do....	29,217,000
Amount of street sprinkled—	
Daily average ..... square meters..	1,115,231
Total per month ..... do....	33,456,955
Gallons of water used daily	138,013
Average cost per 1,000 square meters	$0.117
Daily average cost	$114.68
Street sprinkling with electrozone:	
Force employed—	
Inspectors	1.4
Drivers	5
Assistant drivers	4
Animals	11
Wagons	3
Streets sprinkled:	
Daily average ..... square meters..	160,777
Total per month ..... do....	5,604,087
Daily average, number gallons electrozone	10,700
Average cost per 1,000 square meters	$0.14
Daily average cost	$22.51

Digitized by Google

Men employed and work done in distributing electrozone:

Daily average number of men—	
Drivers	3
Assistant drivers	3
Animals	6
Wagons	2
Daily average number gallons distributed	3,500
Daily average cost per 1,000 gallons	$2.27

Collection of refuse.—There has been no material change in the organization of this subdepartment. The expenses have been materially reduced by taking off some of the extra men on the carts who were doing the loading, and giving to the drivers the work both of loading and driving as far as possible. It has been found necessary, however, in the heaviest collection district to have men at the field who are not assigned to one cart alone, but load for two or more. The efficiency was increased by substituting 55 cubic feet cart bodies for the old 33 cubic feet ones and by the gradual weeding out of small mules and replacing them with heavier and stronger ones. The average cost of collection per ton has been reduced from $2.16 to $1.41.

Again, continuous service has developed a sort of esprit de corps among the men. They take an interest in their work, and vie with each other in efficient performance. It is thought probable that any further reduction in number of men or mules will be detrimental and that with the coming of unfavorable weather it may be necessary to augment the present force of both men and mules.

	Average number of men per month.	Animals.				Carts.	Tons collected daily.	Total number tons collected.	Cost per ton.	Total cost per month.
		Horses.	Mules.	Oxen.	Total.					
July	314	15	124	10	149	102	355.9	9,635	$1.62	$15,666.05
August	297	15	119	10	144	97	358.3	9,646	1.57	15,179.59
September	300	13	117	9	139	91	380.8	10,405	1.45	15,154.50
October	218	8	105	4	117	82	361.4	9,808	1.43	14,031.96
November	216	6	98	2	106	83	348.6	9,060	1.25	11,343.60
December	230	8	94	3	105	82	376.4	10,268	1.15	12,015.94
Average	262.5	10.8	109.5	6.3	126.6	89.5	363.56	9,803	$1.41	$13,903.60

Disinfected houses.—The cost of removing material from infected houses included in preceding table is shown by months, as follows:

September	$249.00
October	258.50
November	234.00
December	235.78
Total	977.28

Disposal of refuse.—The headquarters of this subdepartment are located at Tallapiedra, at the foot of Factoria street, and no material change in organization was made during the period from July 1 to December 31, 1900. The work is done entirely by hired labor, and includes the disposal of all refuse from the city of Habana, with the exception of Vedado (district No. 5).

Repairs to department tug Deulofeu.—This tug is used by the subdepartment of disposal of refuse for the towing of the scows to sea and back, and for other necessary work of this department. Extensive repairs to this boat having become necessary, bids were called for.

The project for the repair work, as approved August 10 and November 8, 1900, was for overhauling, cleaning, and repairing boilers, engines, and all machinery; refitting and readjusting unserviceable parts with new material, and making changes in the machinery that will increase the utility; readjusting and aligning shaft; replacing a number of hull plates; overhauling and replacing parts of the interior of the tug, the deck and rail; putting in new gong and jingle bells, and speaking tubes for communication between the engine room, pilot house, and after deck, and painting the tug throughout.

The following bids were received:

Krajewski-Pesant Company, Habana	$13,750
George M. Newhall Engineering Company, Habana, the boat to be delivered at the company's wharf on the Delaware River	9,375
Merrill-Stevens Engineering Company, Jacksonville, Fla., boat to be delivered to the company at Habana and to be returned to Habana at the expense of the bidder	10,145

Digitized by Google

GARBAGE SCOW ON BEACH, EAST OF MORRO CASTLE.

Digitized by Google

Digitized by Google

LUDLOW PLACE, JANUARY, 1901.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

The bid of the Merrill-Stevens Engineering Company, being for the shortest period and also the lowest, considering the expense of delivering the tug on the Delaware and returning her to Habana, the contract was awarded to this company. The contract was signed and approved September 15, and the boat left Habana September 17, reached Jacksonville from quarantine September 25, and work was begun immediately. No money was paid on the contract until fully 75 per cent of the work had been completed. The only payment was made in December, and was for the sum of $4,263.07.

All work on this project contracted for was completed on the 27th day of December, 1900, and the boat sailed for Habana on January 1, 1901, having been detained by unfavorable weather, and arrived at Habana on January 4.

Wreck of scow.—During the overhauling of the department tug, a hired tug was used, an arrangement which has not been wholly satisfactory. On the afternoon of November 12, 1900, while coming in from a trip to sea, during heavy weather, a towing line parted, one scow was washed ashore and five laborers were drowned. The bottom of the scow was considerably damaged. Plate herewith shows the scow upon the rocks where she was beached on the ocean front about three-quarters of a mile east from Morro. This scow was jacked up and on the morning of December 4, 1900, was hauled off the beach. A few days later it was hauled and placed upon a marine railway, and repairs, estimated to take about ten days, begun. These repairs were done under written proposal and written acceptance. While thus handicapped by the temporary loss of the scow, stormy weather set in, and it became necessary to hire scows for a few days, upon which to store the refuse which could not be sent to sea immediately.

This accident also demonstrated the necessity of an addition of two more scows to the plant. These scows can be built by the department of street cleaning and parks. In this connection it may be well to state that the pay roll of men employed in unloading these scows at sea is approximately $16,000 a year. Hence, in case of the construction of additional scows it is recommended that they be of a type which will render unnecessary the employment of such a large force of men.

To render disease germs innocuous both at the grounds and on board the scows, a thorough system of disinfection is carried on by this subdepartment. For the purpose of this disinfection, electrozone, slaked lime, chloride of lime, and crude petroleum are used.

Cremation.—Cremation is employed to a limited extent for the purpose of disposing of all dead animals and infected material. The consumption of coal was suspended on June 25, 1899. Since the use of coal at the crematory was stopped all kinds of wood collected from the streets and material from disinfected houses have been used as fuel, thereby greatly decreasing the cost of cremation, as shown by the tables.

Character of refuse:		
House and street refuse	tons..	54,254
Slaughterhouse offal	do....	2,109
Night soil	do....	8,048
Sewer dirt	do....	1,663
Cinders	do....	1,148
Total	do....	67,222
Average per month	do....	11,203.6
Method of disposal:		
Cremation	per cent..	6.2
Removal to sea	do....	92.0
Filling in yard	do....	1.8
Cost of disposal:		
Cremation	per ton..	$0.53
Removal to sea	do....	.59
Filling in yard	do....	.107

The increase in the cost of disposal of refuse was caused by the necessity of hiring a tug for towing the scows to sea during the withdrawal of the department tug *Deulofeu* from service for repairs, and in the meantime it was necessary to hire a tug for towing the scows to sea, a full statement concerning which will be found elsewhere in this report.

Care and preservation of parks.—There has been no material change in the methods or personnel in this department since July 1, 1900. The force employed and the cost of maintenance of the parks have been slightly reduced, thus making a larger proportion of allotments available for permanent improvements; these improvements being made with the view of changing the existing parks from mere places for the cultivation of flowers, etc., to breathing spaces, which are so necessary to a thickly settled city such as Habana.

Digitized by Google

In Colon Park the improved section has been maintained in excellent condition, and one quarter of the southeast cuarton of the park has been regraded and grass planted.

Special work of improvement has been carried on in India Park, where one-half of the park has been sodded and walks built.

There has been started, and about two-thirds completed, the improvement of four small squares of public land in the Cerro, in front of San Salvador Church. This park is built to improve these unsightly pieces of public land.

A complete remodeling of La Punta Park is about 85 per cent completed; the work was made necessary by the building of the sea wall at La Punta. It is designed to make an appropriate end for the Prado, the main central promenade and double drive being carried northerly to the water front. Arrangements have also been made so that the drives and walks will connect with any development made to the westward along the sea front.

The average force employed in the care and preservation of parks, including such improvements as are made from time to time, is shown in the following table:

Average daily force employed for parks six months ending December 31, 1900:	
Superintendent	1
Messenger	1
Transitman	1
Draftsman	1
Rodmen	3
Chief gardener	1
Gardeners	7
Florist	1
Inspectors	3
Foremen	3
Laborers	45
Cart drivers	3
Masons	.6
Painters	.3
Boys, sweepers	15
Timekeepers	1
Carpenters	.1
Total daily average force employed	87
Daily average cost of force employed	$122.50
Daily average number of carts for six months	3.05

Average amount of work done monthly during the six months ending December 31, 1900:	
Square meters cleaned	3,458,399
Square meters sprinkled	3,271,091
Square meters graded	12,026
Square meters grass cut	22,359
Square meters grass planted	1,334
Square meters grass weeded	2,315
Times fountains cleaned	582
Trees planted	144
Trees transplanted	181
Potted plants attended to	17,342
Flowers cut	16,141
Benches repaired	30
Tons street sweepings received and used	480
Tons sand received and used	54
Tons cocoa received and used	73
Tons sod received and used	30
Gallons of electrozone received and used	3,500

Special service.—This branch of the service consists of a well-organized body of guards and watchmen, whose duty it is to watch and guard all municipal property over which the department of street cleaning and parks, engineer department of the city of Habana, has control.

From and including September, 1900, the force was reduced so materially that the expense of the department was decreased $550 monthly, and this change was effected without lessening the efficiency of the service.

All the members of this organization are uniformed and supplied with storm coats to protect them from inclement weather. The day is divided into three watches of eight hours each. Inspectors are required to make reports every hour during the day and night by telephone to the central office, and to make a written report of all movements and the guards visited, as well as all happenings of interest, to this department once daily.

The telephone service for communication between points where guards are stationed has been materially improved.

Special investigation work and all translations for the department of street cleaning and parks are made by this branch of the service.

The force employed and average cost per month for the six months ending December 31, 1900, are shown in the following tables:

Digitized by Google

Superintendence.

Months.	Superintendents.		Clerks.		Inspectors.		Subinspectors.		Foremen.	
	Number.	Amount paid per month.	Number.	Amount paid per month.	Number.	Amount paid per month.	Number.	Amount paid per month.	Number.	Amount paid per month.
1900.										
July	1	$125.00	1	$90.00	3	$225.00	3	$180.00	3	$150.00
August	1	125.00	1	90.00	3	225.00	3	185.00	3	150.00
September	1	125.00	1	90.00	3	225.00	3	185.00	3	175.00
October	1	125.00	1	90.00	3	225.00	3	185.00	3	175.00
November	1	125.00	1	90.00	3	225.00	3	174.17	3	175.00
December	1	125.00	1	90.00	3	225.00	3	163.34	3	175.00
Average	1	125.00	1	90.00	3	225.00	3	178.75	3	166.66

Total amount paid per month and number of employees.

	Amount paid.	Number of employees.
July	$770.00	11
August	775.00	11
September	800.00	11
October	800.00	11
November	789.17	11
December	778.34	11
Grand total	4,712.51	66

Guards and watchmen.

Months.	Parks.		Street cleaning.		Total.	
	Days service, guards.	Cost.	Days service, watchmen.	Cost.	Days service, watchmen.	Cost.
1900.						
July	1,302	$1,907.67	1,077	$1,424.58	2,379	$3,332.25
August	1,302	1,918.68	1,184	1,586.02	2,486	3,504.70
September	1,061	1,553.48	1,196	1,567.74	2,257	3,121.22
October	1,097	1,580.14	1,264	1,663.51	2,361	3,243.65
November	1,050	1,531.97	1,239	1,640.07	2,289	3,172.04
December	1,065	1,586.45	1,229	1,624.07	2,314	3,204.52
Total	6,897	10,072.39	7,189	9,505.99	14,086	19,578.38

Wages range as follows, per month:

Superintendent	$125
Clerk	90
Inspectors	$70 to 90
Subinspectors	55 to 65
Foremen	50 to 55
Guards	40 to 45
Watchmen	35 to 40

STABLE NO. 2.

This stable, situated at No. 128 Figuras street, covers an entire block, an area of 5,538.15 square meters. The buildings form a hollow square, with a feed room apart and within the inclosure. Separate stalls are provided for 300 animals, and the entire place is kept scrupulously clean, electrozone being used daily in all parts of the building where animals are kept. At this stable are maintained the animals and carts used by this department for the collection and disposal of refuse, and for the street, sewer and water, and sanitary departments.

At the beginning of this period a number of the animals were infected with glanders, most of which have died. The suspects are all isolated, so as to prevent any further spread of the disease.

Digitized by Google

Of the 275 animals on hand on the 31st day of December, 1900, only 14 were unfit for service, these being temporarily disabled by slight injuries.

The following table shows the number of animals on hand and the cost of maintenance, by months, for the period July 1 to December 31, 1900:

Month.	Horses.	Mules.	Oxen.	Total.	Average daily cost.	Average monthly cost.	Total monthly cost.
1900.							
July	20	228	19	267	$0.768	$23.80	$6,356.55
August	20	229	27	276	.657	20.37	5,622.47
September	20	229	14	263	.754	23.26	6,119.40
October	21	236	32	289	.77	23.88	6,903.70
November	19	240	26	281	.789	23.70	6,659.40
December	18	241	25	284	.806	24.96	7,089.92
Total	118	1,403	143	1,660	4.544	139.97	38,741.44
Average	20	234	24	276.6	.757	23.33	6,456.90

The items which make up the daily cost of maintenance per animal are shown by the following table:

Superintendence	$0.0586	Work in harness shop	$0.0152
Repairs to vehicles	.0404	Watchmen	.06785
Tools, implements, and materials	.0507	Care of animal	.15617
Forage	.3256		
Stable improvements	.02338	Total	.7569
Blacksmith work	.0190		

The difference in cost of maintenance shown in this report and that in the last annual report is largely due to the fact that formerly many employees really chargeable to the stable were charged to the different subdepartments of the department of street cleaning and parks, and in addition to this, cost of shoeing animals, repairing harness, and buildings, etc., has been added to the cost of maintenance, in addition to which has been added the expense of a more thorough and careful superintendence, which was made necessary on account of the rearrangement of the work of collection of refuse.

Condemnation and sale of animals.—Eighteen oxen, 12 mules, and 1 horse, making a total of 31 animals, housed at this stable, were condemned by the inspector-general and sold under the direction of the property clerk, engineer department, city of Habana, on December 22, 1900, for the sum of $1,065.

The proceeds derived from the sale of these animals were turned into the treasury of the island.

STABLE NO. 3.

This stable is located on Colon street between Monserrate and Zulueta streets. It covers an area of 2,022 square meters, which is paved with granite, concrete, and macadam. A complete description of this stable, with all its conveniences, is given in the last annual report.

The same causes for the increase in cost of maintenance of animals during the period apply as to stable No. 2.

Of the total number of 175 animals on hand in this stable on the 31st day of December, 1900, none were unfit for service. General health and conditition of these animals excellent.

The following table shows the number of animals on hand and the cost of maintenance, by months, for the period July 1, 1900, to December 31, 1900:

Month.	Horses.	Mules.	Total.	Average daily cost.	Average monthly cost.	Total monthly cost.
1900.						
July	38	103	141	$0.76	$25.02	$3,527.80
August	37	110	147	.72	22.58	3,319.17
September	37	117	154	.81	24.36	3,751.50
October	37	119	156	.827	25.62	3,997.14
November	39	120	159	.822	24.58	3,920.91
December	39	125	164	.824	25.56	4,192.75
Total	227	694	921	4.763	147.67	22,709.27
Average	37.8	115.6	153.5	.794	24.61	3,784.87

Digitized by Google

The following table shows the items which make up the daily cost of maintenance per animal:

Superintendence	$0.0661	Work in harness shop	$0.0292
Repairs to vehicles	.0581	Watchmen	.0519
Forage	.2993	Care of animal (labor)	.19555
Tools, implements, and materials	.0444		
Stable improvements	.01685	Total	.7938
Blacksmith work	.0324		

REPAIR SHOPS.

These shops are located near the foot of Revillagigedo street and along the southerly side of the westerly half of the hospital militar. They were formerly located at the corner of Trocadero and Zulueta streets, but were moved to their present location in order to secure sufficient room to do the work quickly and more economically.

The average monthly pay roll for this period was about $2,000, and the average monthly expenditure of material about $500. The average number of men per day employed during this period was about 27.4.

This work consists principally of repairs to carts employed in the subdepartment of collection of refuse, and of sprinklers employed in the subdepartment of street sprinkling.

Early in this period it was determined to build a number of cart bodies of 55 cubic feet capacity each, and put them on the running gear of old broken-down cart bodies; this was carried out and resulted not only in increased efficiency in the subdepartment of collection of refuse, where most of the carts were used, but reduced the per cart rate of repairs very materially. Two ox-cart bodies of 90 cubic feet capacity were constructed and are now in use removing department stable refuse.

The nature of the repair work on the collection-of-refuse carts varies greatly. It includes the making of new shafts, refilling wheels and shrinking tires, repairing or rebuilding the bodies, welding of broken axles, making tail gates and hooks, and many minor repairs too numerous to mention. The more expensive repairs are upon the older cart bodies, which will in time be replaced by new ones.

In addition to work of this sort is construction and repair of the bodies of sprinkling wagons and the repair of running gear and valves, carriage repair, plumbing and tinsmith work, repairs to office furniture, and general office repair work, etc. It is hoped that it may be possible to add some machinery and a power plant, thereby increasing the capabilities of the shops.

Repairs to carts include the construction of thirty-five 55-foot and two 90-foot bodies, made with extra heavy hard-wood sills mortised for braces, and every weak point of the body is reinforced by heavy iron braces. These bodies were constructed to replace old and useless ones and made possible the material reduction in carts that is shown in the collection of refuse. Average cost, including new shafts, $45.

Repairs to sprinklers include the construction of three 750-gallon tanks and setting up three new 750-gallon Austin sprinklers, and of four electrozone wagons of 500 gallons capacity each for the sewer department, and two 200-gallon tanks for the subdepartment of street sprinkling.

About 4 per cent of the entire labor was consumed in making the transfer of shops from the old site to the present one, making the necessary changes to buildings, and the adjustment of mechanical appliances; 5 per cent was consumed in miscellaneous repairs shown in table, and 1½ per cent in changes in the arrangement of office at Tacon 3, including the construction of a number of shelves, file cases, and small tables.

Daily average force employed and cost, shown by months, for period ending December 31, 1900.

Months.	Average number of employees daily.	Cost of labor, daily average.
1900.		
July	22.6	$51.03
August	18.87	65.05
September	23.78	61.388
October	34.78	72.625
November	27.5	60.569
December	24.9	47.77
Total cost of labor for period, including superintendence		$10,989.45

Digitized by Google

Repair work done during the six months ending December 31, 1900.

Total number of repairs to carts	864
Total number of repairs to sprinkling wagons	247
Total number of repairs to light wagons	106
Total number of repairs to lawn mowers	23
Total number of electrozone wagons (500 gallons) repaired	4
Total number of electrozone carts (250 gallons) repaired	2
Total number of wagons repaired	8
Total number of hydraulic jacks repaired	7
Total number of wheelbarrows repaired	128
Total number of push carts repaired	8
Total number of ambulances repaired	3
Total number of park benches repaired and painted	67
Total number of garbage forks made	72
Total number of tampers made	36
Total number of rakes made	12
Total number of fire-plug keys made	9
Crematory covers repaired	2
Concrete forms constructed	10
Sewer box, 32 by 4 by 6, constructed	1
Shanty for sentry	1
Miscellaneous repairs, number of items	539

SPECIAL WORKS.

These projects were prepared by the chief engineer of the department, and are state works, although carried on by the forces of the chief engineer, city of Habana.

RESTORING LA FUERZA.

This old Spanish fortress is situated between the palace of the lieutenant-governor and the post-office building, fronting the Plaza de Armas, on one side of the public square, on which also faces the palace of the governor-general.

The work in progress around "La Fuerza," named on a French map published in 1762 "Le Vieux Chateau," is designed primarily to remove certain of the more modern structures which had been built around it for barrack purposes, so as to restore at least one angle of the ancient moat as far as practicable, and to give a better view of the ancient work from the street.

The following extracts from various writers give a portion of the history of this interesting relic of the past.

[Translation.]

WHAT WE WERE AND WHAT WE ARE, OR OLD AND NEW HABANA.

[By José María de la Torre. Published in 1857.]

FORTIFICATIONS—LA FUERZA.

La Fuerza was the first fortress built in Habana. During the sacking and burning of the city by pirates in 1538 it was destroyed, but was afterwards rebuilt. The construction of this fortress was originally begun by Fernando de Soto, then governor of the island. The engineer, Capt. Mateo Aceituno, was the first mayor of Habana.

Although not entirely finished, a royal decree was issued in 1544 requiring war ships coming into port to salute the place and recognize it as a fortification. It was named La Fuerza, because all fortifications were so called, and after other forts were built this one was called "Fuerza Vieja" (old fort).

In the middle of the last century it was surrounded by a moat, in which an armor room was built, but the ditch was afterwards filled up. Governor and Captain-General Juan de Tejeda resided at La Fuerza in 1589. From 1718, at which time it was occupied by Governor Gregorio Guaso, it continued to be used as a palace by his successors, until the command of Conde de Ricla, who lived in the house at present occupied by the naval commandants.

Governor Francisco Cajigal, who was in command of the island from 1747 to 1780, made many beautiful interior improvements, built the rampart and also the upper and lower apartments running along the south side for use of the cavalry and infantry. The round tower, in which a bell was suspended, was used to announce the hours, and during the day to repeat the signals from Morro by the use of flags.

HISTORY OF CUBA.

[By Urrutia. Published in 1791.]

Aceituno constructed the fortress La Fuerza. The first stone was placed by the seashore at the end of the channel and at the mouth of the villa, opposite Cabaña, to command the entrance and detect incoming vessels (which the direction of the entrance channel allows) and keep them under fire. Besides being constructed with four bastions, one in each angle, it is solidly built, though not very thick. Its height was from 24 to 25 yards, and the terraplenes were built over subterraneous arches, surrounded by a wide ditch, washed by the sea.

The name "Royal Fort" was given to the place. It was the first fortress constructed on the island, and the second in the Indies. The only fort preceding it was the one in Santo Domingo.

Digitized by Google

LA FUERZA. GENERAL VIEW FROM STREET, NOVEMBER, 1900.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

RESTORING LA FUERZA. MOAT AT WEST ENTRANCE, JANUARY, 1901.

Digitized by Google

Digitized by Google

HISTORY OF THE PROVINCE OF NUEVA ESPAÑA.

[By Arrete. Published in 1761. Book 1, page 23.]

This fuerza is built on the west boundary of the bay, facing the hills of Cabañas, on the city front, opposite the mouth of the port, which is entirely commanded. It is a quadrilateral fortress of medium size, with four bastions, one in each of its angles. Although somewhat small, it is very strong, its wall being double and its terraplenes built on arches. The walls are 24 to 25 yards high, and the fort is surrounded by a ditch, where an armor room was built lately in one of the prominent angles. The entrance to the port, as well as the Plaza de Armas, can be distinctly seen from the fortress. In one angle there is a tower with bells to sound the hour by day and night, and from the towers also, by the use of flags, signals from the Morro are repeated.

In 1718, General Guaso moved there as governor of the island, the same as Maestro de Campo, D. Juan de Tejeda, had done before. The fortress continued to be used as a palace or residence by his successors. All these governors have improved the place according to the needs of their families, especially Mariscal de Campo, D. Francisco Cajigan, who added to it a portion as a receiving parlor on the caballero which faces the sea, adorned the interior by coat of arms and medals of plaster and luxurious sculpture, and the exterior by a round balcony. This latter governor constructed the present path and the upper and lower south compartments for the cavalry and infantry troops.

OF THE CALLE MENOR DE INDIAS.

[By Juan Dias. Chapter 38.]

The position of the alcalde or commandant of this fortress was for some time annexed to that of captain-general and governor of the island. It is specified in a royal decree, dated at El Pardo, November 21, 1590, of which I shall speak later, but I am sure that, besides Captain Aceituno, Diego Fernández de Quiñones, Sergeant de Argüelles, and after this Francisco Diaz Pimienta, D. Antonio Manuel de Aguila y Roxas, and his son, Captain Juan Caballero, of the Order of Santiago, native of this city, who was the last mayor of this fortress, held the same position before it was assigned to the governor.

The fortress was undoubtedly the commencement of the fortification of Habana, the benefit of which was afterwards felt by the city, as in the years 1543-44, when Juan de Aguila was governor of the island, four war vessels and one French *Potache*, of which Roberto Baal was commander, disembarked some men at the point where Castilla La Punta now stands, but were repulsed with the loss of many lives by the fire opened on them from the artillery at the fort. The enemy, suffering greatly by this unexpected resistance, were panic-stricken and retired.

The project, contemplating the clearing out of the moat around the southeast bastion of La Fuerza and the removal of the building as far as the outside barrack of La Fuerza, also the removal of the iron fence and wall between La Fuerza inclosure and the street, and parking the inclosure, was approved September 8, 1900. Work was begun immediately and until November 28, 1900, consisted almost entirely of earth excavation from within the moat. From this time until December 6 the work was confined to wall demolition; from December 6 to December 21, earth excavation and wall demolition were carried on simultaneously and the wall demolition was completed. A little earth excavation was done during the remainder of the period, mostly to uncover the old moat wall to enable the rebuilding of it to begin. The iron fence in front was also taken down and part of the wall on which it stood removed.

On December 27 this work of rebuilding the moat wall was started and was in progress on December 31, 1900. The work is done by hired labor, and on December 31 was about 40 per cent completed.

There remains to be done the completion of the wall, the disposal of four cannons and carriages, some additional earth excavation, the parking of the whole area, the reerection of the iron fence across the bottom of the moat, the construction of a driveway for carts alongside the present post-office building, putting up some screens to be covered with vines, the restoration of the drawbridge to its original condition, and repairing the south face of the southeast bastion.

The accompanying photographs show the condition of the grounds and buildings before any work was done and show the state of affairs about the last of December, 1900.

Force employed, cost of labor and materials, and work done are shown by the following tables:

COST OF LABOR AND MATERIALS.

Total number of working days during the period	56
Daily average force employed	17.12
Daily average cost of force employed	$21.596
Daily average cost of materials	2.67
Total	24.266
Total cost of labor to date	1,209.38
Total cost of materials to date	150.00
Total	1,359.38

Digitized by Google

WORK DONE.

Total number cubic meters excavated	1,437
Total number cubic meters of material removed	2,200
Total number cubic meters of wall torn down	366
Total number cubic meters of wall built	9½

EXTENDING SEWER AT NORTH END OF TACON STREET.

The project for this work, approved by the military governor November 2, 1900, is for extending the sewer at the north end of Tacon street farther into the bay and building a riprap retaining wall across the angle formed by the sea wall at this point and filling between the riprapping and present wall by material excavated at La Fuerza.

A box sewer was constructed of 3-inch yellow-pine lumber, 32 feet long, 4 feet high, and 6 feet wide, and placed at the point indicated. The riprap wall and about 250 cubic meters of filling have been placed.

This sewer formerly emptied through the wall into an angle, where there was a constant eddy, caused by the current, and all floating material emptied into the bay by this sewer remained at this outlet. The place was a constant menace to public health, and for this reason it was necessary to carry the sewage into the bay to a point where the refuse would be carried away by the currents.

The daily average force employed and total amount of work done on Tacon sewer from November 6 to December 31, 1900, is shown by the following table:

Daily average force employed	6.5
Daily average cost of force employed	$8.853
Total number of tons filling placed	250
Total cost of labor to date	$495.80
Materials for box	50.00
	545.80

IMPROVING CORTINA DE VALDES.

This small park, which is located between the monastery attached to the cathedral at the foot of Empedrado and Chacon streets and the sea wall along the harbor front, was in a very dilapidated condition, and the improvements made have converted it into a very attractive evening resort. Work was begun August 29 and completed December 31, 1900.

The project as approved by the military governor September 5, 1900, was for removing stone and débris from the space between the north end of the Cortina de Valdes and the Maestranza building; restoring walls, fountains, and inclined planes; mounting nine of the eleven guns on carriages, placing a curbing around the base of each gun, and sodding the inclosed space, parking the interior, and paving between it and the Maestranza.

The cost of labor and materials are shown in the following tables:

Daily average force employed	9.33
Daily average cost of force employed	$25.57
Total cost of labor	1,994.74
Total cost of material	1,459.87
Total	3,454.61

WORK DONE.

Total number square meters paved	150
Total number square meters excavated	195
Total number square meters graded	465
Total number square meters grass planted	700
Total number linear meters curbing placed	467
Total number guns mounted complete	11

CONSTRUCTING SEA WALL AT LA PUNTA.

Under the Spanish law the land washed by the waves of the sea at the highest tides and during storms is the property of the State. Landward from this shore property another strip 6 meters wide, denominated a "service zone," is also reserved for public uses. Rights of occupancy for these lands were granted only by royal orders, and generally only temporary rights were granted. Under the operation of these laws the sea front of Habana has been unbuilt on, excepting for fortifications and for temporary bath houses, leaving a bare space extending from La Punta, in the rear of San Lazaro street, to the terminus of San Lazaro, and thence west to the Almendares. This space has been encroached on from time to time, with or without authority, but in general it has a width which ranges from 50 meters to 100 meters, excepting at the inlets near the Reina battery.

Digitized by Google

EXTENSION OF TACON STREET SEWER. BOX SEWER IN PLACE, NOVEMBER 1, 1900.

EXTENSION OF TACON STREET SEWER. FILLING IN PLACE, JANUARY, 1901.

Digitized by Google

Digitized by Google

CORTINA DE VALDES, LOOKING NORTH, APRIL, 1900.

CORTINA DE VALDES, LOOKING NORTH, JANUARY, 1901.

Digitized by Google

Digitized by Google

CORTINA DE VALDES. FOUNTAIN AT NORTH END, AUGUST, 1900.

CORTINA DE VALDES. FOUNTAIN AT NORTH END, JANUARY, 1901.

Digitized by Google

Digitized by Google

CORTINA DE VALDES. RAMP AT SOUTH END, AUGUST, 1900.

CORTINA DE VALDES. RAMP AT SOUTH END, DECEMBER, 1900.

Digitized by Google

Digitized by Google

LA PUNTA, FROM MORRO, MARCH, 1899.

LA PUNTA, FROM MORRO, JANUARY, 1901.

Digitized by Google

Digitized by Google

LA PUNTA, APRIL, 1900.

SEA WALL AT LA PUNTA. EXCAVATING, SEPTEMBER, 1900.

Digitized by Google

Digitized by Google

SEA WALL AT LA PUNTA. COPING MOSTLY COMPLETED, OCTOBER, 1900.

SEA WALL AT LA PUNTA. WALL COMPLETED, GRADING FINISHED, DECEMBER, 1900.

Digitized by Google

Digitized by Google

SEA WALL AT LA PUNTA, SHOWING CONSTRUCTION OF TOE.

SEA WALL AT LA PUNTA. EFFECT OF TOE ON WAVE ACTION.

Digitized by Google

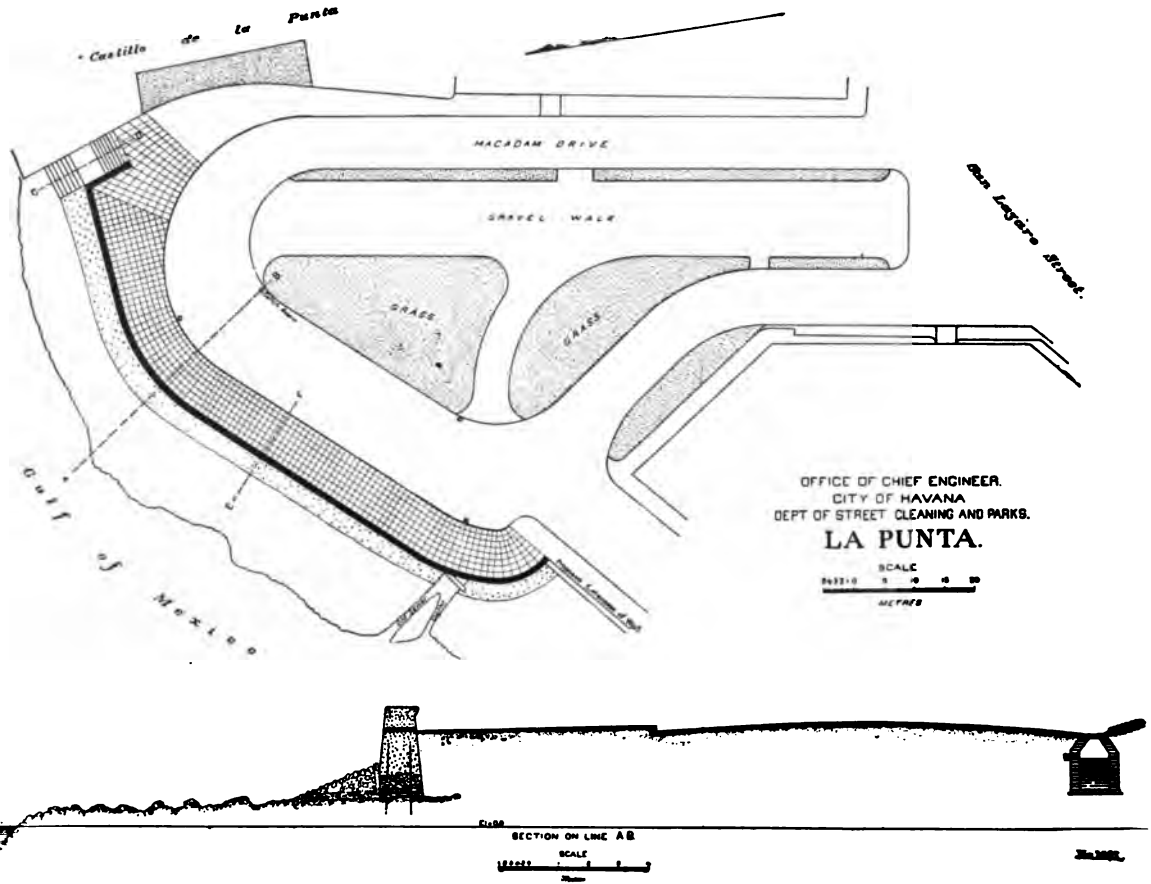
Digitized by Google

SURF ON SHORE WEST OF LA PUNTA.

SURF AT LA PUNTA.

Digitized by Google

Digitized by Google

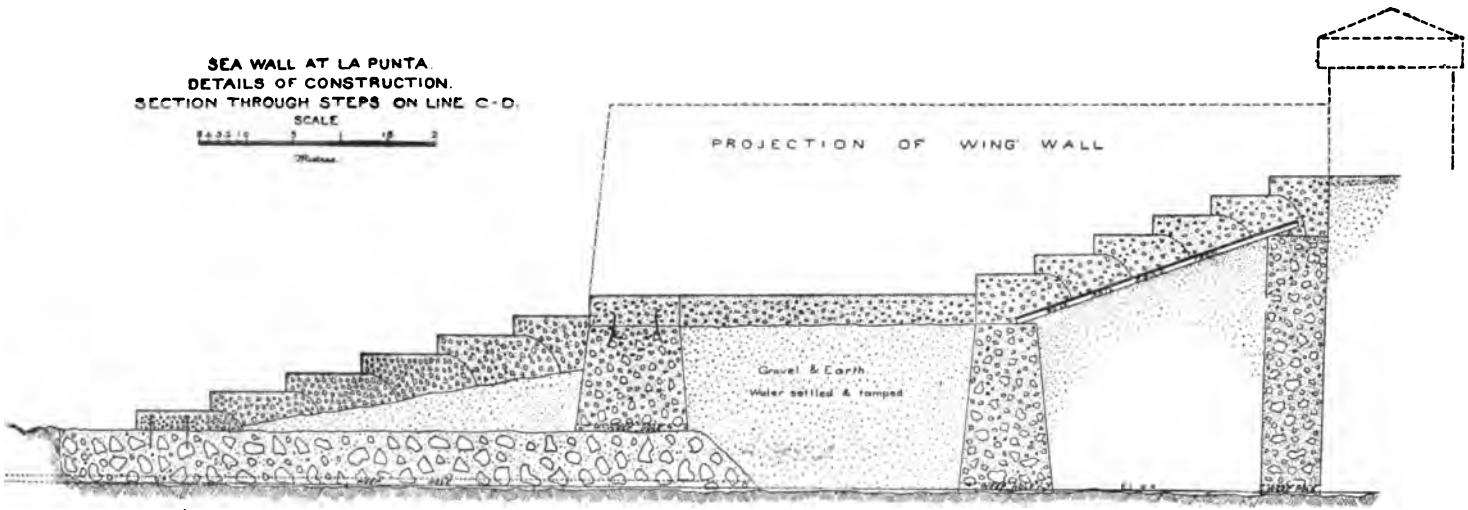


Digitized by Google

Digitized by Google

SEA WALL AT LA PUNTA.
DETAILS OF CONSTRUCTION.
SECTION THROUGH STEPS ON LINE C-D.

SCALE

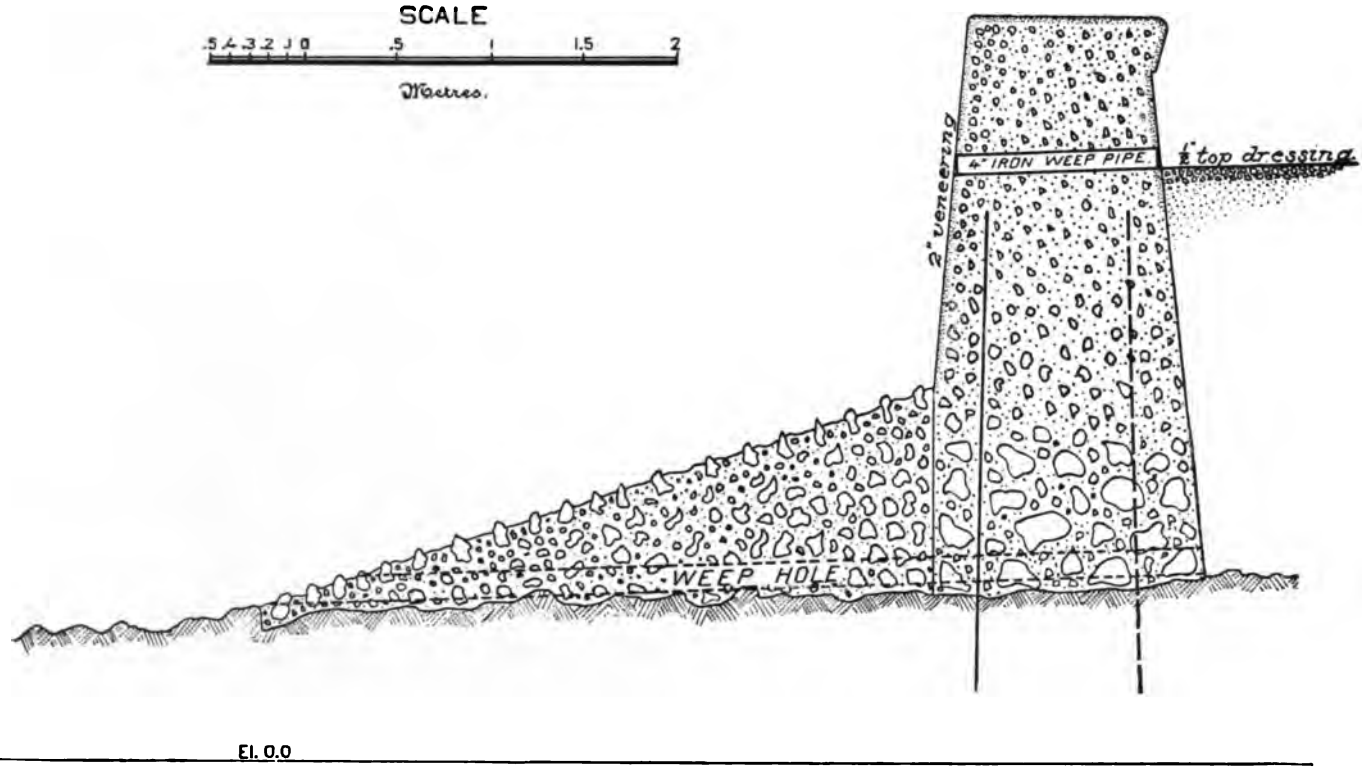


No 1602

Digitized by Google

Digitized by Google

SEA WALL AT LA PUNTA.
DETAILS OF CONSTRUCTION.
SECTION THROUGH WALL ON LINE E-F.



Digitized by Google

Digitized by Google

It has long been the desire of those in authority in Habana to utilize this space for a parkway and road, and about 1875 Colonel de Albear, a distinguished engineer officer of the Spanish army, serving in Habana, formed a project for this work. For some reason his plans were never approved, and at the time of the American occupation the space was used as a dump, was only partially drained, and was generally in an unsanitary condition. At an early date thereafter it was cleaned and partly filled, as proper materials became available, and during the summer of 1900 an appropriation was made, under a project made by the park department, under the direction of the chief engineer of the division, to begin the work by constructing a sea wall with a concrete promenade from La Punta to the west side of the Prado, and for the protection of the space thus improved as a park.

Colonel de Albear's plans were not followed, since these were made when the old fort of La Punta was still useful for defensive purposes, and for that and other reasons, under more modern conditions, it was found that they could be improved upon.

At the Punta the wall ends in a broad flight of concrete steps, which give access to the rock beach, makes a good breakwater, and, what is most important, makes it unnecessary to join the modern curved wall directly to the severe lines of the ancient masonry of the fort. To prevent too much splashing of water over the wall during heavy weather, and to diminish the force of the blow of a wave against the wall, it is located about 30 feet back from the high water line, and an inclined toe, with stones projecting above its surface, was built along the outer face. This arrangement, in the storms which have occurred since the wall was built, has been found to fulfill its object.

The project for this work was approved by the military governor August 11, 1900, and embraced the construction of a sea wall 112 meters in length, extending from the northwest bastion of La Punta battery to the sewer emptying into the Gulf at the north end of the Prado, and the construction of a concrete pavement 8 meters wide along its entire length.

The work was begun on the 20th of August, 1900, and the entire project, except a small amount of street grading, was completed on the 31st of December, 1900.

Prior to the commencement of the filling which led to the parking of the space between the street-railroad track and the present sea wall at the north end of the Prado the entire area was flooded by sea water during heavy northerly or northeasterly storms. A sewer emptied into the northeast corner of the space, and a considerable portion of the area immediately above high-water mark was covered with trash and refuse of various kinds, the whole presenting a very unsightly appearance.

The effect of wave action on the north face of this filling was closely watched, and from these observations it was decided that it could be maintained with a surface elevation of about 3 meters above mean low water and the protection of a wall in front, the top of which should be about 4 meters above mean low water. Although there has not been what might be considered a severe northerly storm since the wall was finished, observations of the two worst storms that have taken place warrant the belief that it will prevent any serious damage to the improvement and should be continued to the westward on about the same lines as rapidly as filling for backing can be obtained.

No piece of public improvement in this city has met with such universal appreciation and approval. In addition to the evidence of this shown by the number of persons frequenting the place daily, hundreds of verbal testimonials from prominent and interested persons have been received.

DESCRIPTION OF THE WORK AND METHODS EMPLOYED.

The toe was constructed first, in blocks 10 feet long; the steps were then brought up to the height of the top of the toe, an elevation of 2 meters above mean low water. This preliminary wall, extending the full length of the proposed improvement, gave protection against wave action during the construction of the more important features. The wall proper was built in sections ranging in length from 10 to 15 meters, with vertical dovetailed joints.

The steps were constructed at the rate of one per day, so as to give ample time and opportunity to properly prepare, by puddling and tamping, the gravel and sand foundation. In the lower flight of steps it was not deemed necessary to use iron beams, as the space betweeen the lower layer of concrete and that forming the steps was so small that a water-settled or puddled and tamped foundation was considered sufficient. The landing between the two flights of steps is so formed and constructed that its settlement will not interfere in any way with the steps either above or below it.

The upper flight of steps is strengthened by the use of five bars, 80-pound steel railroad rails, resting upon the vertical walls upon which the steps are founded and embedded into the lower face of the concrete composing the steps. The natural rock

Digitized by Google

surface upon which the wall is founded, which is of the rough and irregular character usually found on the shores in this latitude (where calcareous limestone exists), would, under ordinary circumstances, have been considered sufficient to guarantee stability, but from the fear that failure to properly clean the rock surface or that insufficient tamping might have resulted in weakness, the wall was bolted to the rock with 1-inch iron bolts 2½ meters long, with large nuts on both ends, set to a depth of one-half meter into chambered holes 2 meters apart and staggered. The section employed in step construction is novel and is expected to give considerable additional strength, with little or no additional cost.

The mixtures employed were as follows:

The toe, 1 part cement, 3 parts sand, 6 parts broken stone; top dressed, 2 inches deep with a mortar of 1 part cement and 2 parts sand.

The wall, 1 part cement; 2½ parts sand and 5 parts broken stone; faced or veneered on exposed surfaces, a depth of 2 inches, with a mortar of 1 part cement to 2 parts sand, which was placed layer by layer against the planed form boards, immediately prior to placing the concrete, and tamped as part of it.

The steps, 1 part cement, 2 parts sand, and 3 parts screened and washed gravel, faced on exposed surfaces with a mortar of 1 part cement and 1 part sand.

The pavement, 1 part cement, 4 parts sand, and 8 parts broken stone for a depth of 3 inches with one-half inch top dressing of 1 part cement to 1 part sand.

Each section of the work was carried on without interruption in order to prevent planes of weakness other than those contemplated and provided for. The molded coping of the walls is built in sections 3 meters long, with vertical dovetailed joints and keyed to the wall proper by means of a channeled key way, 6 inches by 6 inches, extending the entire length of the wall and by similar ones extending across at right angles to the axis of the wall at intervals of 5 feet.

The pavement was laid in 1-meter squares with sand joints after the manner described on page 81, report of Maj. W. M. Black, corps of engineers, chief engineer Department of Cuba, and a curb 6 by 16 inches was tamped in sections 3 meters long with sand joints.

The following table shows cost of labor and material:

Daily average force employed	25.65
Daily average cost of force employed	$51.10
Total cost of labor	4,496.22
Total cost of materials	5,070.71
Total cost	9,566.93
Total cubic meters excavation made	1,212
Total number cubic meters concrete placed in construction of sea wall	736
Total number square meters concrete placed in construction of pavement	980

GRADING AND CLEARING LOTS AROUND PORTIONS OF OLD CITY WALL.

The project for this work was approved by the military governor August 14, 1900, embraces the removal of all the fence around portions of old city wall lying between Monserrate, Zulueta, Obrapia, and Dragones streets; removal and disposing of all débris, grading and sodding the plots lying on both sides of the wall, and constructing macadam walks around them.

This place was not only an eyesore, but surrounded as it was with an old fence with a board knocked loose here and there, was used by the laboring classes as a dump for all kinds of refuse, and was consequently a constant menace to the public health.

All the work has been completed except a small amount of sodding and the macadam walk. It is not deemed advisable to complete the walk until the adjacent streets have been repaired, since this work will be done at once and the work done on the walk would be destroyed in the process of grading and paving the streets.

The work was begun on this project August 27, 1900, and at the close of operations, December 31, 1900, 83 per cent of the entire project had been completed.

The following tables show work done and cost of labor and materials:

Daily average force employed	18.32
Daily average cost of force employed	$21.083
Daily average cost of materials	5.961
Total	27.044
Total amount expended to date	4,219.93
Work done:	
Total number square meters graded	5,640
Total number square meters grass planted	6,951
Total number square meters grass weeded	200

Digitized by Google

GRADING AND CLEANING LOTS AROUND PORTIONS OF OLD CITY WALL. NORTH LOT, AUGUST, 1900.

GRADING AND CLEANING LOTS AROUND PORTIONS OF OLD CITY WALL. NORTH LOT, JANUARY, 1901.

Digitized by Google

Digitized by Google

GRADING AND CLEANING LOTS AROUND PORTIONS OF OLD CITY WALL. SOUTH LOT, AUGUST, 1900.

GRADING AND CLEANING LOTS AROUND PORTIONS OF OLD CITY WALL. SOUTH LOT, JANUARY, 1901.

Digitized by Google

Digitized by Google

DEPARTMENT OF WATER AND SEWERS.

[Mr. Ovidio Giberga, assistant engineer, superintendent.]

This department comprises the following branches:

Water department: Mr. W. W. Kenny, superintendent of mains and service pipes; Mr. R. Van Dreissche, superintendent of aqueduct and reservoirs; Mr. Andres Balaguer, in charge of Zanja Real; Mr. W. S. Cadwell, in charge of Palatino pumping station; Mr. Felipe Ascencio, in charge of Casa Blanca pumping station; Mr. Daniel Torrens, in charge of inspection of water waste and meters; Mr. Eduardo Adot, permit clerk.

Sewer department: Mr. R. H. Keays, assistant engineer, in charge of preparation of plans for new sewer system, with Messrs. Gideon, Young, and Torrance as assistants; Mr. R. M. Moore, assistant engineer, in charge of sewer cleaning and repairs; Mr. B. F. Davenport, in charge of sanitary plumbing and drainage.

Night soil department: Mr. Wm. Kennedy, in charge of night soil branch.

Electrozone plant: Mr. G. C. Rowe, in local charge.

Water department.

The improved condition of the water supply of the city of Habana, as reported at the end of the last fiscal year, has been kept up in a satisfactory manner. The system has been extended by laying new mains and new service pipes, furnishing water to localities where it is needed, and thus contributing to the health and comfort of the inhabitants thereof. The general methods of work and classifications as reported in the last annual report are still in force. The work of the water department may be divided into the following subheadings: Installation of new house-service pipes; repairs to old house-service pipes; installation of new fire hydrants and repairs to old; dividing the water-main system throughout the city into subdistricts controlled individually by the operation of gate valves; increasing the pressure heads in the higher levels by controlling the flow in the lower levels; extension of new mains to territories without water in the city proper; furnishing water supply to the suburbs; maintenance of the works at Vento, the aqueduct from Palatino to Vento, and Fernando VII aqueduct; maintenance of Palatino reservoir and Zanja Real; report of water surveyors; water meters; miscellaneous works.

INSTALLATION OF NEW HOUSE-SERVICE PIPES.

During the past six months 269 new services have been installed, for which the usual fee of $15.20 has been collected by the ayuntamiento. The connection with the main pipes is made at the top or side, according to circumstances, and at sufficient depth from the surface of the street to be protected from the traffic thereon. A brass corporation cock is used for making the connection to the main, its nipple being screwed thereto, and an 18-inch lead connection with wiped joints attached to it. Heavy galvanized-iron pipe, varying in dimensions according to the size of installation, is carried to the service cock, which is placed 18 inches inside the curb or sidewalk line and protected by a telescopic box.

The cost has been as follows:

Labor	$871.07
Materials	2,003.87
Total	2,874.94
Average price per installation	10.69

REPAIRS TO OLD HOUSE-SERVICE PIPES.

In order to avoid waste of water and to maintain the service in good condition, this branch of the work has received special attention, 515 repairs having been made during the six months' period covered by this report. Many of the leaks reported proved to be on the owner's side of the service cock, and in these cases the owner was notified and directed to have the repair made at once.

It may be noted that with the improved condition of the services and the improved water pressure, only 26 complaints of having no water have been reported, all of which have been attended to and the trouble remedied at once.

Number of breaks reported	573
Number of breaks repaired	515
Found no breaks	58
Number of complaints of no water	26
Number of complaints of no water attended to	26

Digitized by Google

The cost of this work has been:

Labor	$2,543.05
Materials	2,684.12
Total	5,191.17
Average cost	10.06

In addition to the above, 506 telescopic boxes have been installed around old valves, in order to more fully protect and control the water supply.

The cost ot this work was $753.09, divided as follows:

Labor	$347.05
Materials	406.04
	753.09
Average cost of each	1.49

INSTALLATION OF NEW FIRE HYDRANTS AND REPAIRS TO OLD.

There have been placed in the past six months 27 new fire hydrants, all of which have been provided with brick valve chambers for 4-inch auxiliary valves to facilitate the repair and cleaning of the hydrants without interfering with or closing the water service in their circuits. Some of these hydrants are also used by the department of street cleaning and parks for supply of water for street sprinkling.

The keeping in repair of the old style of fire hydrants is a matter of constant care. Whenever repairs are made to any of these, auxiliary valves and valve chambers are installed, for the reasons stated in the preceding paragraph. The number of times that hydrants have been cleaned and repaired is 4,063.

The total cost of this work has been:

Labor	$825.29
Materials	2,189.79
Total	3,015.08
Average cost of installing new hydrants	57.70
Average cost of cleaning and repairing hydrants	.36

DIVIDING THE WATER-MAIN SYSTEM THROUGHOUT THE CITY INTO SUBDISTRICTS CONTROLLED INDIVIDUALLY BY THE OPERATION OF GATE VALVES.

As stated in the last annual report, "Owing to the limited number of valves on the main system, a large territory was deprived of water whenever repairs to breaks were made or modifications required in the line. These objectional features have been partly overcome by dividing the city into small independent water circuits. With the installation of many new valves the danger of shutting off the water from large and populous districts is avoided." Little has been done under this heading during the past six months, owing to the pressure of more important work, but it is proposed to continue this work during the remainder of the year.

One hundred and one manholes of different sizes have been installed throughout the city. Most of these manholes were constructed around valves previously installed, but in a number of cases new valves and chambers were placed. The cost of this work has been:

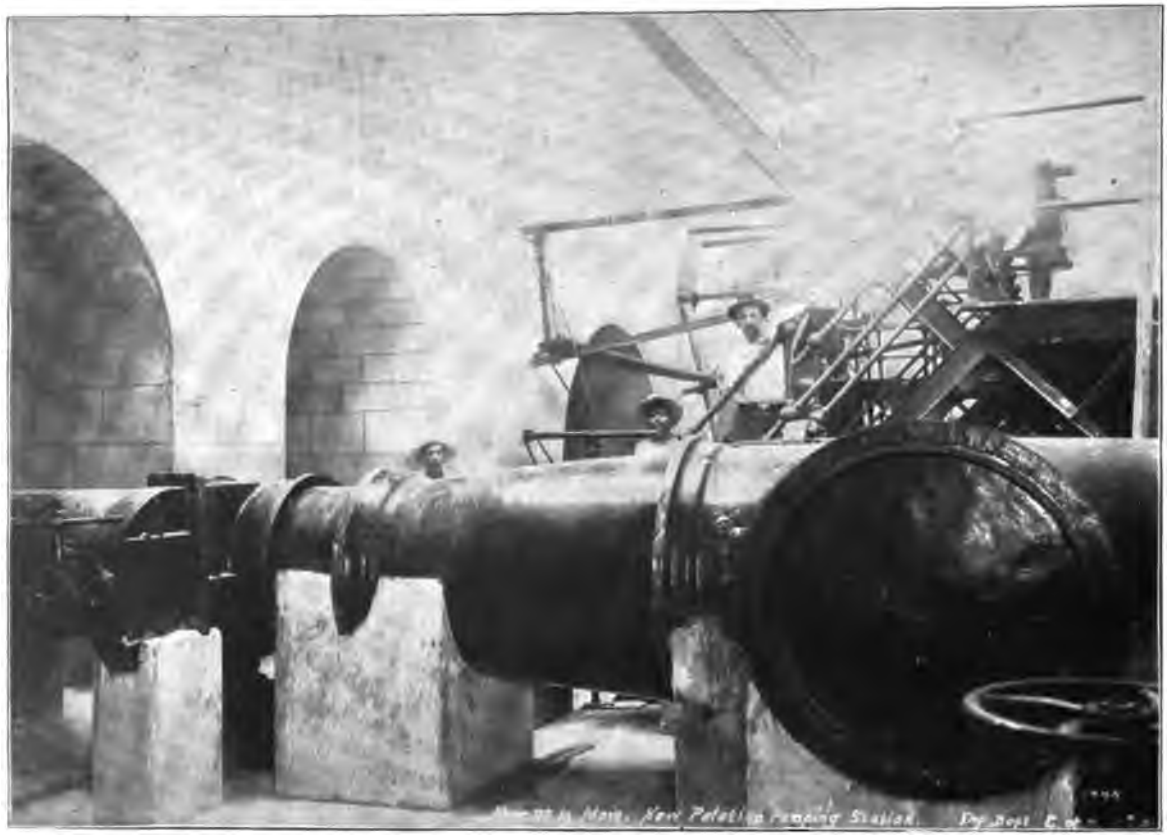
Labor	$1,237.88
Materials	2,358.04
Total	3,595.92
Average cost of each	35.60

INCREASING THE PRESSURE HEAD IN THE HIGHER LEVELS BY CONTROLLING THE FLOW IN THE LOWER LEVELS.

The efforts to increase the pressure heads in the high levels by controlling the flow in the lower levels, as reported on page 60 of the last annual report, have been continued with satisfactory results, and water is now furnished at all hours to the high section of the city proper. It is believed that in the near future when more of the old pipes have been replaced or altered to suit the different levels, this work will not require the careful attention it has received so far.

The success of the work reported in the last report under the heading "reducing friction in existing mains by cross connections and increasing the radii of curves" is shown by the fact that the pressures taken in December, 1900, show an increase, in some instances, of 5 meters over those of December, 1899; the average increase being 1.3 meters. This increase will undoubtedly continue, especially as more meters to prevent the waste of water are introduced.

Digitized by Google



PALATINO PUMPING STATION. NEW 30-INCH MAIN.

Digitized by Google

Digitized by Google

EXTENSION OF NEW MAINS TO TERRITORIES WITHOUT WATER IN THE CITY PROPER.

The entire work of laying new mains in the city proper during the last six months has been from funds received from the ayuntamiento.

For laying a 4-inch main on Zequeira street between Consejero Arango and Zarabia streets $339.36 were received. The work was commenced on October 12 and completed on October 14, at a cost of $68.89 for labor and $180.19 for materials; a total of $249.08. The average cost per linear foot was $0.76. One hundred and fifty-five dollars and twenty-six cents, for materials taken from the stock of the water department, have been charged to the account, which is not shown on the financial statement. The unexpended balance was returned to the ayuntamiento.

For the supply of water from the Zanja Real to the Tamarindo farm and several others, $1,200 was received from the ayuntamiento, and 211 feet of 8-inch cast-iron pipe and 482 feet of 8-inch tile pipe laid before the beginning of the period covered by this report. The work was stopped, awaiting the opening of San Carlos street, by the ayuntamiento, and the only expenses during the past six months were $73.54 in finishing work begun in the last fiscal year.

For the supply of water to the Habana Brewery, on the Palatino road, $1,901.08 have been received from the manager through the ayuntamiento. A 6-inch pipe line, 1,572 feet long, was laid from the new 30-inch main connecting the reservoir and the new Palatino pumping station, and the necessary valves and 6-inch meter installed. The cost of laying the pipe was $454.98 for labor and $1,446.10 for materials, a total of $1,901.08, or an average of $1.21 per foot. The cost of the meter and valves was $660.10, which was paid to the ayuntamiento by the brewery company.

FURNISHING WATER SUPPLY TO THE SUBURBS.

A. Improvement of water supply to Quemados, Camp Columbia, and Principe.—A full statement of the object of this work and the results accomplished up to June 30, 1900, will be found on page 58 of the last annual report of the engineering department.

The work now in progress includes the erection of a new pumping station, the purchase and installation of one 800,000-gallon pump to supply Vento water to the high portions of the Cerro, Jesus del Monte, Camp Columbia, and the military buildings at Quemados, Aldecoa Hospital, quartermaster's corral, Pirotecnia, Military Hospital No. 1, and Mercedes Hospital.

During the past six months 240 feet of 30-inch cast-iron pipe, 12 feet of 24-inch, 6,888 feet of 10-inch, 1,152 feet of 8-inch, 12 feet of 6-inch, and 51 feet of 4-inch pipe have been laid, together with 4 fire hydrants; four 10-inch, one 6-inch, eight 4-inch, four 8-inch, and one 30-inch valves.

A contract with Sussdorff, Zaldo Company, of Habana, for furnishing and installing the 800,000-gallon pump, at a cost of $6,300, was executed September 21 and approved October 20, the work to commence within seven days after date of notification of approval of contract, and to be completed within seventeen weeks from the date of commencement. The contractors state that the pump will be delivered and placed on time.

On October 1 a contract was executed with Parker, Waugh & Co., of this city, to construct the building for the new pumping station at a cost of $7,200, exclusive of the foundation, which was placed by this department. This contract, which was approved on October 8, provided that the building would be completed within forty-five working days from date of notification of approval, which notification was made on October 13. The contract expired on December 5, at which time the work was not completed. By approval of the military governor an extension of thirty days was granted to the contractors. On the 30th of December the work on the building was only about 70 per cent completed, and it does not seem probable that it will be finished before the extension expires.

Funds from the original allotment for this work are now on hand to cover the two contracts, on which no payments have as yet been made. This original allotment proved insufficient to complete the entire work covered by this project, and authority was granted to use money from the regular appropriations for the water department for this purpose. The expenditures during the past six months for completing the stack, laying the pipe line, valves, etc., the foundation for the building and additional work on the building have been:

Labor	$4,924.97
Materials	12,730.83
Total	17,655.80

Operation of the Palatino Pumping Station: The station has been kept in as good condition as possible, and has been operated during the entire period covered by this report. The total cost of operation has been $2,400 for labor, and $2,749.04 for material; a total of $5,149.04, or an average cost per day of $28.61.

Digitized by Google

B. Casa Blanca water supply.—The extension of the Vento system to supply water to Casa Blanca and the garrison at Cabaña, by means of a 6-inch flexible-joint cast-iron pipe laid across the harbor, the installation of a pump and erection of a water tank on the high ground near Cabaña, was reported in the last annual report. This system has been maintained in good condition throughout the past six months, and has been extended to supply the new immigrant camp at Triscornia.

The pumping station has been maintained in good condition and has been improved by the addition of an automatic steam admission regulator, connecting with a float with a small suction tank, and by putting an air chamber on the suction pipe.

The water tank has been repainted at a cost of $250.

The cost of operating the station has been:

Labor	$630.00
Materials	169.68
Total	799.68

An average cost per day of $4.44.

The extension of the system to supply water to the immigrant station was made from funds allotted for that purpose.

C. Luyano and Regla Line.—The installation of this line was reported on page 57 of the last annual report of this department. Eighteen new services have been established along this line in and around the town of Luyano. House connections are made with a ¾-inch regulating valve, and the owners charged at the rate of $20 and $40 per year, according to the rental value of the house. Farms and a few manufacturing establishments are supplied with water through meters at the rate of 4 cents per cubic meter.

Owing to the opposition on the part of the alcalde of Regla to the conditions prescribed by this office under which the Vento water was to be supplied to that municipality, no water was furnished until December, at which time, the conditions having been fixed by the division commander, the supply was turned on on December 10, 1900. A 4-inch meter has been placed on the Luyano road at the limit of the municipalities of Habana and Regla, and the ayuntamiento of Regla is to pay to the municipality of Habana 4 cents per meter for all water passing this point. Water is to be supplied to the citizens of Regla under such restrictions and at such rates as may be prescribed by the ayuntamiento of that town, subject to the approval of the military governor of the island.

D. Vedado and Carmelo water supply.—Under the terms of a concession granted in 1894 to the firm of Bautista, Díaz & Co., that company was authorized to supply and sell Vento water to certain portions of the towns of Vedado and Carmelo, the supply to be taken from the city main at the corner of Infanta and Principe streets and carried by a 12-inch pipe to the distribution mains of these towns.

By Circular Order No. 4, office of the governor of Habana, March 23, 1899, it was ordered: "That the city will hereafter collect all water rentals in the suburbs of Vedado and Carmelo; that all water takers will hereafter make payment of water rents and charges to the city through its authorized agents; that the present arrangements for the collection of water rentals by Messrs. Bautista, Díaz & Co. are hereby terminated, and the alleged concession, contract, or agreement between the firm named and the city is hereby abrogated and declared null and void. The ascertainment of such residual equities in the so-called contracts as may be claimed by the said firm will be remitted to the courts, upon the instance of the contractors."

Under the terms of the above order this office took charge of this system, and numerous repairs, improvements, and extensions were made. Up to September of the past year the extensions to the system included the laying of 2,772 feet of 8-inch, 3,624 feet of 6-inch, 575 feet of 4-inch, and 2,985 feet of 3-inch cast-iron pipe, with valves, hydrants, etc., at a cost of $13,130.90. Repairs to the system had been made to the number of 126 and at a total cost of $907.03. Thirty-eight new house installations, 17 reinstallations, 3 suppressions, and 27 changes of house connections from old to new mains have been made.

Order No. 313, headquarters division of Cuba, dated August 11, 1900, revoked the order above quoted, and reinstated "Bautista, Díaz & Co. in their relations to the city of Habana in all that pertains to the Vedado and Carmelo waterworks and dependent claims affected by above-mentioned order."

In compliance with this order, and with the terms of an indorsement from headquarters of the division, dated September 5, 1900, which directs that "Bautista, Díaz & Co. be immediately placed in possession of their property, i. e., the Carmelo-Vedado aqueduct, and in addition to the property as it existed March 23, 1899, the chief engineer will turn over to them such additions and improvements as have been made by the government, without, however, in any way prejudicing the rights of

Digitized by Google

the government to recover from Bautista, Diaz & Co. the cost of such additions and improvements as have been made in the past," on September 6 this department formally transferred to Bautista, Diaz & Co. the control of the Carmelo-Vedado water system, as it existed at that date.

Since then this department has had no control over the service of water to these two suburbs.

E. Installation of public fountain at Casa Blanca.—For the purpose of supplying water to the poor at Casa Blanca, the ayuntamiento of Habana allotted $245 for erecting a public fountain. With these funds a handsome cast-iron fountain, provided with two drinking cups and a horse and dog trough, was erected at a cost of $198.44 for material and $32 for labor; total, $230.44. The balance of $14.56 was returned to the ayuntamiento. A photograph of the fountain is appended.

Petitions have been received from the property owners of Arroyo Apolo, Puentes Grandes, and Ceiba, small villages on the outskirts of Habana, to be supplied with Vento water, and studies are now being carried on to supply water to these places.

MAINTENANCE OF THE WORKS AT VENTO, THE AQUEDUCT FROM VENTO TO PALATINO, AND THE FERNANDO VII AQUEDUCT.

A description of these works will be found in the last annual report, pages 59–60.

The main basin at Vento has been cleaned regularly, the work consisting of scraping sidewalks, bottom, and removing all impurities and vegetable matter. The walk around same was weeded and all roots extracted. It was raised 6 inches with small stones and gravel used as a top bed, which was crowned at the center and afterwards rolled.

Towers Nos. 1 to 10 of the aqueduct from Palatino to Vento have been repointed and painted, and work on the other towers and on the buildings is now in progress. The screens of the aqueduct have been removed and cleared every week and the gates repaired and oiled. All roots within a radius of 1 meter of any concrete or masonry work have been removed to prevent damage to the works and to avoid filtrations of rain or creek water. Three hundred and fifty meters of road have been repaired and rebuilt along the line of the mains, and much work of an incidental character done, keeping the grounds and property in good condition.

The total cost of work at Vento and on the tunnel was $2,853.73 for labor and $170 for material, total of $3,024.03, or an average per day of $16.80.

The Fernando VII aqueduct from Salvador street to Santa Rosa street has been thoroughly repaired during the past six months. It was in bad condition, as it had not been properly cared for for many years. Large roots of trees had grown into the crevices of the stone blocks, forcing them out of place. This aqueduct carries both the old Fernando VII 20-inch pipe and the 42-inch main from the Palatino reservoir. Both pipes now carry Vento water, but in case of an accident the 20-inch pipe which comes from the Almendares River can be used to bring water from that source. The roots were removed, the blocks replaced, the cracks and joints pointed and put in proper condition to withstand the action of the weather, at a total cost of $605.24—$385.38 for labor and $219.86 for material.

The filter beds at the head of the old aqueduct on the Almendares River were cleaned and weeded at a cost of $64.80.

MAINTENANCE OF PALATINO RESERVOIR AND ZANJA REAL.

The two tanks of the Palatino reservoir have been alternately cleaned every twenty days, to prevent the accumulation of vegetable growth. The gate valves, chambers, mains, and iron steps have been repainted, and a new 30-inch main has been laid from the west end of the 42-inch main in the valve chambers to a tee at the wet well of the new Palatino pumping station, as previously mentioned. A 30-inch valve was placed in this pipe. From this tee a new main may be laid in the future to the city. This main was laid at a depth of 23 feet, and had to be carried through the wall of the reservoir building. A photograph is appended, showing the 30-inch valve and the junction of the main with the 42-inch main in the reservoir chamber.

A description of the Zanja Real will be found on pages 58 and 59 of the last annual report. The only work that has been done on this part of the water system during the last six months has been of a sanitary nature, mostly in cleaning and keeping the aqueduct free of obstructions. Eighty-five thousand one hundred and sixty linear feet of cleaning and weeding from the Almendares River to the foot of Príncipe Castle cost an average of 13 cents per linear foot; 1,800 cubic feet of earth and rubbish, washed in by the heavy storms of June and July, were removed at a cost of 25 cents per cubic foot; 700 cubic feet of earth were spread and tamped for repairs in

Digitized by Google

different places at a cost of 21 cents per cubic foot, and 2 old 4-inch valves that had been left by the Spanish were installed as water inlets for the Medina farm.

The total expenditures for this work amounted to $2,136.05, including the salary of an employee engaged to watch and care for the Zanja.

REPORT OF WATER SURVEYORS.

The work done under this heading includes the inspection of all houses in the city, with a view of obtaining data necessary for compiling a complete plan showing all house numbers, their street frontage, length of block in which located, dimensions of water mains in different streets, with dimensions of supply pipe to each house.

When a house is inspected note is made of the number of occupants, number of rooms or apartments, damaged faucets, water-closets with constantly running water or otherwise in bad condition, whether the supply of water is taken fraudulently from other houses, and any information which would be of value to the department. In order to stop the waste of water where abuses of the supply are found, the property owners are compelled to repair the services under the supervision of an inspector.

The information collected by the inspectors has proven very valuable to the interest of the city, and at present the number of complaints received of the scarcity of water is very small. As previously reported, water is now furnished to the most elevated parts or the city where formerly it was impossible to obtain a supply.

The department now possesses a complete plan of the city of Habana, on which is platted all information of this character collected to date.

The cost of this work during the last six months has been $1,635 for salaries of inspectors, an average per day of $9.08.

Work done:		Work done:	
Houses inspected	10,999	Rectifications of house front measurements	675
Leaks found	1,092	Locations of houses corrected	112
Houses taking water from others	1,272	Tanks which have been provided with valves	23
Water-closets without tank found	539	Tanks without valve found	37
Houses without stopcocks found	665	Water services turned on	6
Houses without water	2,138	Direct connections between steam engines and main pipe found	2
Houses reinspected	2,149	Connections to steam engines placed according to municipal ordinances.	1
Constant running water-closets changed	502		
Leaks repaired	818		
Notices sent to owners	1,749		

WATER METERS.

There are 24 water meters in use throughout the city of Habana, 13 of which have been installed during the period covered by this report. Bills for the water consumed are forwarded by this department to the ayuntamiento for collection. The amount consumed during the last six months through these meters has been 28,118 cubic meters. Four of these meters have been placed for the use of the Habana Electric Railway Company, in connection with the work of relaying their tracks, and the locations of the same are changed from time to time as the company may request, the cost of the work being paid by the railway company, The total cost of the work in connection with installing water meters has been $762.21, of which sum the Habana Electric Railway Company has paid $416.08 for work done in connection with their operations.

MISCELLANEOUS WORK.

A large amount of work not classified under any of the foregoing heads, including clerical work of the office, supervision of the general work, and numerous small projects, have been carried on during the six months.

Eight water services have been installed in the parks for the use of the street sprinkling service, at a cost of $22.50 each. Repairs to the water service of the Olavarrieta School, at a cost of $12.64, were made from funds appropriated by the ayuntamiento. General work, comprising emergency and night work, employment of watchmen upon unfinished work, boat hire, etc., has cost $909.32.

Work of lowering and repairing of water pipes in various parts of the city, due to operations of the Habana Electric Railway Company in relaying their tracks, has cost $1,603.08, of which $442.33 have been paid by the company, and bills for the balance have been forwarded for payment.

A large quantity of materials purchased for general and emergency work of the water department is on hand, the cost of which is included in the financial statement of the engineer department.

The monthly pay rolls for the assistant engineer, superintendent in charge, assistant engineers, clerks, draftsmen, inspectors, and the regular force of the department during the six months ending December 31 was $12,278.49, of which amount $4,655 is included in the cost of works covered by this report.

Digitized by Google

DRINKING FOUNTAIN, CASA BLANCA.

Digitized by Google

Digitized by Google

Sewer department.

A full description of the organization of this department will be found on pages 62 and 63 of the last annual report, together with a full description of the condition and character of the sewers of the city.

The work of the department is described under the following headings: Maintenance and improvement of old sewers; preparation of plans and collection of data for new sewerage system; sanitary plumbing and house drainage; cement testing plant; night soil removal and electrozone plant.

MAINTENANCE OF OLD SEWERS.

The sewers of Habana, as described in detail in the last annual report, were built for local purposes only, and were constructed with little regard to a proper design. They appear to be a series of drains, each built to drain a separate district only, rather than a complete sewer system for a large city.

The grades are usually badly arranged, the form of the sewers rectangular, the material of the walls rough stone of a porous nature, or common brick, and the bottom very often the natural earth. Their construction is the cause of many obstructions, causing constant cleaning, which work under present conditions is very laborious and expensive. Direct house connections are not allowed, only the overflow from cesspools being permitted to enter the sewers.

In the outlying districts the sewage is carried in open ditches with plank covering, and much work has been done in cleaning and disinfecting these open ditches.

Most of the sewers and drains throughout the city were placed in fair sanitary condition during the last fiscal year, and the work of the department on the old sewers has been mainly devoted to maintaining the sewers and catch-basins in sanitary condition. No new work has been undertaken, except such cases as sanitary conditions demanded.

It has been necessary in some locations to make quite extensive repairs to old sewers, and also to lay sections of vitrified pipe sewers in different localities throughout the city, which work may or may not be made to form parts of the new sewerage system.

The following tables show the work performed in maintaining the old sewers and work done in laying sections of new sewers for sanitary purposes:

Work done on old sewers:	
Linear feet of closed sewer cleaned (average cost per foot, $0.005)	2,769
Linear feet of open ditch cleaned (average cost per foot, $0.005)	57,851
Breaks in sewer reported	413
Breaks in sewer repaired (average cost, $5)	413
Catch-basins cleaned	6,613
Cart, days	1,491
Loads of dirt removed	5,388
Old catch-basins replaced	65
Catch-basins installed	45
Linear feet of pipe drain constructed (12, 9, and 8 inch)	2,256

Improvement of old sewers; new sewers constructed.—Cerro street, 430.144 linear feet of 6-inch pipe, at a cost of $23.70 for labor and $64.64 for material and cart hire, a total of $88.34; Consejero Arango street (Cerro), 172 linear feet of 4-inch pipe, at a cost of $16.10 for labor and $37.95 for material and cart hire, a total of $54.05; Carlos III street, 276 linear feet of 4 and 12-inch pipe, at a cost of $90.80 for labor and $232.87 for material and cart hire, a total of $323.67; Santa Catalina and La Rosa streets, 290 linear feet of 9-inch pipe, at a cost of $25.90 for labor and $136.18 for material and cart hire, a total of $162.08; Marina street, 180 linear feet of 4, 9, and 18 inch pipe, at a cost of $25.90 for labor and $133.60 for material and cart hire, a total of $159.50; Falgueras and Lombillo streets, 60 linear feet of 4-inch pipe, at a cost of $17.60 for labor and $18.70 for material and cart hire, a total of $36.30; Lealtad and Figuras streets, 684 linear feet of 6 and 12 inch pipe, at a cost of $71.35 for labor and $248.39 for material and cart hire, a total of $319.74; Concha Station, 252 linear feet of 4 and 12 inch pipe, at a cost of $15.20 for labor and $114.19 for material, a total of $129.39; Santa Clara Battery, 130 linear feet of 9-inch pipe, at a cost of $18.10 for labor and $88.01 for material and cart hire, a total of $106.11; House of the Good Shepherd, 4 small catch-basins constructed, 316 linear feet of 4, 6, and 8 inch pipe constructed, and 30 linear feet of brick drain constructed, at a cost of $48.20 for labor and $101.51 for material and cart hire, a total of $149.71; Jesus del Monte from Puente de Agua Dulce to Mangos streets, 1,260 linear feet of 15 and 18 inch pipe installed, at a cost of $122.60 for labor and $938.41 for material and cart hire, a total of $1,061.01.

Digitized by Google

NOTE—None of the pipe used in the above improvements was purchased during the six months, it being stock remaining on hand from the previous period. The cost thereof is, however, included in statement of cost of each piece of work.

Mercedes Hospital sewer.—On March 12, 1900, certain repairs were authorized to be made to the sewer from Military Hospital No. 1, and the Mercedes Hospital, and $1,800 was alloted in April for the work. Upon further examination it was found that the work proposed would be insufficient for the needs of this locality, and that instead of installing an 8-inch pipe it would be necessary to lay a 9-inch pipe from the junction of the sewers from the Pirotecnia and Military Hospital and the drain from the ice factory to the Mercedes Hospital, and a 12-inch vitrified pipe to a catch-basin on Twenty-first street, near Santa Clara Battery, where it is to be connected to an 8-inch cast-iron pipe with a slope sufficiently great to carry all sewage to the sea. In September this project was approved and authority was granted to use, in addition to the special allotment of $1,800, so much of the funds of the regular sewer allotments as might be necessary to complete the work.

Much of the excavation for the sewer was through solid rock, greatly increasing the cost thereof. The work is about 80 per cent completed, and includes the laying of 1,280 feet of 9-inch, and 1,359 feet of 12-inch vitrified pipe, and the construction of 14 brick manholes. The work has been performed in accordance with modern principles, and is at present the best sewer of its kind in Habana, and will be made to form a part of the new sewerage system.

The total cost of the work, including a large amount of tools and implements on hand, which will be used in connection with other work, has been for labor $4,853.98, cart hire $153, and materials $2,352.85, a total to December 31 of $7,559.83.

PREPARATIONS OF PLANS AND COLLECTION OF DATA FOR NEW SEWERAGE SYSTEM.

Attention is invited to the report of Mr. Samuel M. Gray, consulting engineer, of Providence, R. I., for a sewerage and drainage system for the city of Habana, published in full in the last annual report.

In July Mr. Gray's report, together with the general plans, were received, and work was immediately commenced in preparing block detail maps and in studying details for carrying out his project.

Previous to July work was commenced by the department of streets on a series of block maps of the entire city on a scale of 1: 250. It is estimated that there will be over 3,000 of these detail maps, of which about one-fourth are finished. There is also being prepared by the street department a map of the city on a scale of 1: 5000, which was approximately 20 per cent completed on December 31. No accurate maps of Habana have ever been found, and this one is intended to supersede all other maps and furnish a correct map for the various uses of the department.

The method found best for the design of the block details for the sewerage system has been to have tracings made of the block maps and from these to have positive Van Dyke prints made. The Van Dyke prints are used for designing all details, the location of water pipes, gas pipes, old sewers, street-railway lines, depth of rock, and other existing structures are platted on them, together with profiles of the same and the result used as a guide in laying out the new sewers. The design is then added to the tracings in proper conventions, from which blue prints are to be made for use in the field.

All general details so far found necessary have been designed. Special details in the city proper have as yet received little attention.

All work on plans has been considerably delayed by reason of the limited drafting force available for the work. It has been a matter of difficulty to obtain good draftsmen, and it has been necessary to utilize the services of several assistant engineers on the work of preparing plans.

The work on the design for the sewer system in the city proper is divided into six sections, on three of which work is now in progress, viz: East side marginal system, north of Teniente Rey street; East side marginal system, south of Teniente Rey street; and North side marginal system, east of Galiano street.

A design has been made for El Morro pumping station and one almost finished for the temporary works at La Punta.

A design was made for the Punta siphon but abandoned in favor of a flexible-joint siphon. This work has been somewhat delayed, awaiting decision as to the location of the temporary works at La Punta.

The electric sublifts in El Vedado are being designed.

Specifications have been prepared and printed for the entire sewer system.

It was proposed in July to build the sewers on the Prado first without the connections necessary for an outlet. For this it would be necessary to build a temporary

Digitized by Google

pumping station. The design of these sewers was finished in September, but the project was abandoned because of the likelihood of commencing work on the entire system.

It has been necessary to send parties into the field to locate all water pipes and old sewers. Data in regard to gas pipes is obtained from the office of the Habana Gas Company.

In connection with the work of determining the depth of rock 684 borings have been made, and in locating water pipes 1,356.

The character of the bottom of the harbor on the line of the proposed siphon has been thoroughly explored by boring.

For this submarine boring work two different methods have been employed. At first an apparatus using a casing 4 inches in diameter, the material being loosened inside with a drill and removed with an auger, was used, and about the last of November the department obtained the use of a modern water-jet apparatus, using a casing 2 inches in diameter.

The cost of the former method was $1.94 per foot driven, and the latter about $1, which can still be greatly reduced under more favorable conditions.

For purposes of comparison of the amount of work done on the sewer plans, so that a percentage may be stated each month, the entire work is divided as follows:

	Per cent.
East side marginal system	16
North side marginal system	20
South side high-level system	8
North Matadero system	7
Remainder of the city	29
Special work, pumping station, etc	20
	100

These are based on the number of blocks in each section, as allowing for difficulty of design makes the computation too complex.

As subheads, it is assumed that the work on any system may be divided as follows:

	Per cent.
(a) All work in preparation of block maps and Van Dykes ready for the laying of the sewers and drains	25
(b) Designing of sewers and drains	20
(c) Retracing same in proper conventions and blue printing	15
(d) Special details	40
	100

On this basis there is finished 10.05 per cent of the entire work.

The following statement shows the cost of the work done by the sewer department in preparing plans, etc., for the new sewer system. This statement does not include any expenses incurred in connection with that part of the work being carried on by the street department:

Monthly pay rolls	$5,533.84
Daily pay rolls	891.88
Materials (drills, drawing materials, and instruments)	1,648.04
Total	8,073.76

SANITARY PLUMBING AND HOUSE DRAINAGE.

No separate report of this bureau has ever been submitted. During the six months inspection work and official records have been changed and systematized to conform to modern methods. The city is subdivided into six sanitary districts, each in charge of an inspector.

The work comprises preparing, in accordance with modern practices, plans and specifications for installing sanitary plumbing and house drainage, and the inspection of the work as it progresses, in order that the same shall be carried out in accordance with the specifications.

Applications for specifications and plans for new work are nearly all received from the ayuntamiento. In cases where the plumbing and drainage fixtures of a house are found to be in such condition that sanitary precautions require that they be changed immediately, the chief sanitary officer notifies the property owner to make the alterations in accordance with specifications to be prepared by this department. A careful inspection is made of such premises and report made on a regular form, giving a description of all fixtures in place, their condition, the changes sought and needed, together with a sketch of the same for future reference. This report is carefully compared with the application or sanitary order, and specifications prepared

Digitized by Google

for each case. The department has a regular adopted plan for house connections, but in cases where buildings are constructed for purposes other than residences or stores, special drawings are designed, defining the special method for plumbing and drainage, copies of which accompany the specifications.

New sanitary plumbing is installed in such a manner that when the new sewer system for the city is built the interior arrangements will not have to be changed, but it will only be necessary to make a connection with the sewer; but in order that property owners may be put to as little expense as possible, only such work as is absolutely necessary as a measure for the public health is ordered done by the chief sanitary officer.

Permits for all sanitary work are issued by the mayor, and the applications or sanitary orders, as the case may be, are all forwarded through the chief engineer of the city to the mayor.

The following table shows the work done during the six months ending December 31:

Specifications prepared and forwarded to the ayuntamiento in accordance with expedientes received from the city authorities	457
Specifications prepared and forwarded to the ayuntamiento in compliance with requests received from the chief sanitary officer	491
Official communications prepared and forwarded to the ayuntamiento referring to specifications and special information, in reply to request for same	235
Communications prepared and forwarded to the chief sanitary officer referring to complaints, copies of inspectors' reports, and details of work done not complying with specifications of the department	249
Reports of inspectors returned and filed, where installations have been finished as specified	151
Miscellaneous communications	37

CEMENT-TESTING PLANT.

This plant was established in July, but owing to the lack of certain apparatus necessary for the prosecution of the work, only a few tests were made during July and August. Since September the work has been regularly carried on, and the tests have proven of considerable value to the department. Many applications have been received from dealers, requesting that their cement be tested, and it is believed that the operation of this plant will cause many of the inferior brands of cement to be removed from the market.

The cost of operation has been somewhat high, owing to the necessity for the purchase of molds and other appliances.

The following work was done during the period: Neat-cement tests, 66; sand tests, 31; salt-water tests, 8.

NIGHT-SOIL REMOVAL.

The work of this subdepartment in the city of Habana has been carried on during the six months ending December 31, 1900, in the same manner as described in pages 128 and 129 of the last annual report.

Cesspools have been cleaned for private parties upon request, owing to the fact that contractors' prices were so excessive. Contractors equipped with modern apparatus for cleaning cesspools now say that they are willing to do the work for the same charges made by the department, and it is believed that house owners will now be able to have their work done by contractors at a reasonable cost.

The total cost of the operations of the night-soil department in Habana during the six months has been $9,934.64, and bills for work done, amounting to $8,382, have been forwarded to the ayuntamiento for collection. The fixed charges of the department for such work, viz, $3 for the first load and $2 for each additional load removed from any one cesspool would, according to the above figures, seem to be insufficient, but during the first three months of this period the plant was not working to its full capacity, owing to the scarcity of requests received from the chief sanitary officer. When the plant is fully engaged, work can be done at a cost below that charged by the department, so that in establishing the above rates no injustice was imposed upon private contractors. During the months of October, November, and December the cost to the department was $1.97 per load.

In September a branch of the night-soil department was established in Casa Blanca for cleaning cesspools in that place and at Regla. All work in Casa Blanca and Regla was done at the request of the chief sanitary officer. Owing to the limited amount of work done and the expense of providing a place for disposal of the contents of cesspools cleaned in Regla and Casa Blanca, the cost per load has been very high, especially in Casa Blanca, where it was necessary to construct a small stable to properly care for the animals and carts.

The distribution of electrozone has been continued day and night. Three tank wagons have been continuously engaged during the day and four during the night.

Digitized by Google

The small tanks, located at the outfalls of main sewers emptying into the bay, which supply electrozone automatically, have been kept continuously filled. Every sewer opening and public urinal throughout the city have been disinfected daily.

The following table shows the work done in the removal of night soil in Habana, Regla, and Casa Blanca, and disinfection in Habana, with the average cost per day:

City of Habana.

Number of cesspools inspected	1,414
Number of cesspools in an insanitary condition	417
Number of cesspools cleaned and disinfected	589
Number of cubic yards of night soil removed	3,597
Labor	$6,714.72
62 per cent of the monthly pay roll	$1,659.43
Horse hire for period	$90.00
Materials	$596.17
Actual cost of operations as charged to the allotment of this department	$9,060.52
Cost of forage for mules, supplied by the department of street cleaning and parks, 2,700 rations, at $0.3256 per ration	$879.12
Total cost of operations	$9,939.64
Average cost per day	$55.22
Average cost per yard	$2.77
Number of times of disinfecting sewer openings	46,419
Number of times of disinfecting public urinals	4,820
Number of gallons of electrozone used	1,906,189
Labor	$2,386.98
26 per cent of the monthly pay roll	$695.90
Materials	$158.50
Actual cost of operations as charged to the allotment of this department	$3,241.38
Cost of forage for mules, supplied by the department of street cleaning and parks, 3,780 rations, at $0.3256 per ration	$1,230.77
Total cost of operations	$4,472.15
Average cost per day	$24.85

Town of Regla.

Number of cesspools cleaned and disinfected	59
Number of cubic yards of night soil removed	291½
Labor	$632.94
Nine per cent of the monthly pay roll	240.88
Rent of plant at Regla	60.00
Materials	31.20
Actual cost of operations as charged to the allotment of this department	965.02
Cost of forage for mules, furnished by the department of street cleaning and parks, 360 rations, at $0.3256 per ration	117.22
Total cost of operations	1,082.24
Average cost per day	17.74
Average cost per load	3.71

Town of Casa Blanca.

Number of cesspools cleaned and disinfected	11
Number of cubic yards of night soil removed	31½
Labor	$176.88
Three per cent of the monthly pay roll	80.30
Rent of the plant at Casa Blanca	50.00
Materials	16.47
Actual cost of operations as charged to the allotment of this department	323.65
Cost of forage for mules, furnished by the department of street cleaning and parks, 90 rations, at $0.3256 per ration	29.30
Total cost of operations	352.95
Average cost per day	3.97
Average cost per load	11.20

ELECTROZONE PLANT.

[Mr. G. C. Rowe, in local charge.]

During the past six months the plant was in daily operation, producing electrozone of a standard strength, viz, 150 grains of available chlorine per gallon for general disinfecting and 100 grains per gallon for street sprinkling.

Digitized by Google

An electric motor and an emery wheel were installed for cleaning electrode contacts. Switches were installed for controlling lights in basement and tank shed.

Dynamos Nos. 1 and 3 had their commutators re-turned. Characteristics of No. 3 were determined. A large emery wheel was installed for grinding carbon brushes straight and true. The constant, for use in the volumetric analysis, was determined. Drawings were made of the countershaft and proposed changes to allow the installation of a high-duty Corliss engine. Report was made on the necessary changes for the more economical production of electrozone. Storage tanks were lined with bricks and cement, and lead-lined sea-water pipes were put in. All necessary repairs on existing machinery were promptly attended to, thereby preventing any unnecessary delay in the operation of the plant.

Total number of gallons of electrozone produced	5,003,160
Labor (monthly and daily rolls)	$4,340.75
Materials used	8,336.27
Royalty, 685,650,152 grains of available chlorine, at $0.005 per 100 grains	3,428.28
Total cost of operation	16,105.27
Average cost per 1,000 gallons	3.219

DEPARTMENT OF GENERAL REPAIR AND SUPERINTENDENCE MUNICIPAL BUILDINGS.

[Mr. G. W. Armitage, assistant engineer in charge.]

The work of this department during the last six months has embraced the keeping in repair of all municipal and certain state buildings and the preparation of plans and specifications for extensive repairs to state buildings. The work has consisted principally of small but important repairs, usually requiring prompt attention. From funds allotted to this department the salaries of draftsmen, clerks, and foremen have been paid; the permanent force has consisted of 2 draftsmen, 2 clerks, 1 stenographer, and 3 foremen, but fully 80 per cent of the work performed by these employees has been in connection with repairs to or renovation of state buildings, carried on under the supervision of Capt. T. L. Huston, assistant engineer, department of Cuba.

The organization of a working force equipped to promptly execute emergency work requiring immediate attention and at the same time sufficiently elastic to cope with work of larger scope as required from time to time has been perfected and is now in excellent running order.

On August 18 authority was granted to execute all work under the head of "general repair" by hired labor. This arrangement greatly facilitates the work, besides being most economical to the government, it having been proven on several occasions that local contractors are unable to perform work as cheaply as department forces. An addition has been made to the carpenter shop at the Maestranza, an adjacent room having been fitted up as a blacksmith shop, where a man is kept continually employed. There have been collected 12,000 feet B. M., valued at $1,200, of native hard-wood lumber, including the following woods: Sabicu, jocuma, Spanish cedar, jucaro, majagua, chicharron, and acana. These woods were obtained from old buildings that have been overhauled and repaired.

Installing new and repairing old plumbing work comprises a large portion of the emergency work mentioned above. For this purpose a first-class plumber is employed, who performs his work in accordance with the most recent practice in sanitary plumbing. In following his trade here a plumber encounters difficulties of a nature that could only be met with in a city where the style of building is similar to that characteristic of Habana.

The heavy hard-wood floor and roof joists prevent the extension of soil and vent lines without the use of numerous offsets and cleaning screws in old buildings, increasing the cost of the work and retarding the perfect working of an otherwise sanitary plumbing system. Often the conditions are such as to render the work very offensive. It has been the policy to keep all plumbing pipe exposed when conditions would permit. This policy may sometimes have been supported at the sacrifice of appearances, but the desirability of this method may be readily understood.

In public buildings other than those occupied as office buildings, or where it was desirable to preserve a neat and tasty interior, plumbing was roughed out below the floor and supported by hangers between the heavy floor beams. All pipes were exposed and the neatly wiped joints with traps, vents, and cleaning screws were made as little objectionable as possible by being finished in aluminum or bronze.

The style of construction in Habana renders the use of P trap back outlet closets

Digitized by Google

desirable in almost all cases, and especially when it is an object to preserve unbroken the appearance of the ceilings. In installing back outlet water-closets a space 16 inches wide was partitioned off next to the wall. This partition formed the back of the water-closet stall and together with the sides were generally formed on a framework of 1-inch iron pipe covered with expanded metal and finished off with cement plaster, which, after it had become dry, was painted with white enamel paint, forming a hard glossy surface that can be easily cleaned.

A method was devised for securing a pilaster to the front of the partition which served as a door jamb. These pilasters were ornamented or left plain as the condition warranted.

In place of stone safes used in the better class of work in the States, cement safes have been used in Habana. The adoption of cement partitions and cement wastes have answered the requirements of economy and have satisfactorily served the purposes for which they were installed.

The system adopted in large cities of the United States of introducing fresh air to house drains through a pipe leading from the sidewalk to the drain line has been enforced in Habana since the American occupation. A question has arisen as to the advisability of continuing this system, the conditions here, it is claimed, being such as to defeat the results obtained in cities in a more northern latitude. Facts are being collected to determine this question, an investigation having been ordered with this end in view.

The following statement shows the amount paid for permanent employees and amounts expended for repairs to different buildings. Certain sums are charged against this account for work for which a specific and separate appropriation had been authorized, but owing to the emergency of the same it could not be delayed until the funds were on hand. In such cases materials and labor used in general repair are charged against such appropriations for a like amount.

Monthly roll	$6,177.49
Repairs engineer department, constructing drafting tables, etc	1,203.79
Timekeeper	392.50
Foreman	288.13
Watchman and helpers, carpenter and paint shop	404.33
Drivers	886.75
Watchmen, hospital militar	552.00
Labor from B. Weber's roll	6.80
Map and drawing case for archives at La Fuerza	237.50
Governor-general's palace repairs, ayuntamiento	111.00
Matadero repairs	128.13
Tacon Market	65.73
Cristina Market repairs	131.93
Captain of the port building	17.75
Old post-office repairs	12.75
Maestranza Building repairs	61.94
Puerza electric plant repairs	$54.68
Quinta de los Molinos	13.50
Cortino de Valdes	26.25
Dragones Barracks	324.87
Carcel and audiencia	587.13
Mercedes Hospital	73.00
Segundo Cabo	4.28
Military stable	5.84
Municipal vivac	5.38
Headquarters Second Artillery	107.00
Repairs to tools	34.50
Hospital militar, preparing mortar, etc.	106.01
Beneficencia	40.69
Torreon repairs	43.00
Hospital No. 1	7.50
Material, lumber, nails, paint, plumbing supplies, etc	2,541.79
Total	14,658.39

Palatino pumping station.—The work of preparing the plans and specifications for the Palatino pumping station was allotted to this department. The pumping station forms a part of the project for the improvement of the water supply to Quemados, Camp Columbia, and Principe, being carried out by the water and sewer department.

After careful consideration of plans and specifications, during which five estimates were prepared, the object being to construct the building in a manner that would be both serviceable and inexpensive, a project, providing for a brick building 42 by 69 feet by 20 feet to top of parapet wall, with numerous arched openings evenly spaced and separated by pilasters formed of brick with stone bases and caps, was selected. Over the pilaster caps an entablature with architrave and frieze of brick and a heavy cornice of stone, topped by a paneled parapet wall, which in turn is finished with a stone cap, gives character and style to the building. A trussed hip roof, with a Louvre ventilator extending along the ridge of the roof, was designed. The framing of this roof is very strong and substantial, but, for reason of economy, it will for the present be covered with asbestus roofing, which will be treated to two coats of red paint. Paneled doors and glazed and paneled sash will be used in door and window openings. All transoms will be pivoted top and bottom.

The interior will contain a pump room, boiler room, closet, and bathroom. The three latter will be plastered and finished throughout, and the other rooms will be left unfinished. All woodwork will be finished natural. Specifications called for a building complete with the exception of concrete floors and foundations, which were to be provided for by the department.

Digitized by Google

In answer to an advertisement for bids, the following tenders were received and opened:

	Amount of bid.	To be completed.
		Days.
Parker, Waugh & Co.	$7,290.00	45
Purdy & Henderson	9,113.00	90
Sussdorff, Zaldo & Co.	9,544.50	70

Parker, Waugh & Co. being the lowest bidders, contract was executed with them October 1 for constructing the station. The work of superintending the construction of the building was assigned to Capt. T. L. Huston, assistant engineer, Department of Cuba, and attention is invited to his report, with photographs showing the building in different stages of construction.

Habana matadero.—A full report of the necessity for a modern abattoir in Habana, together with a detailed description of the manner in which slaughtering is done in this city, is given on page 193 of the report for fiscal year ending June 30, 1900.

On May 23, 1900, the ayuntamiento appropriated the sum of $8,894.80 for improving the sanitary condition of the Habana matadero, and constructing an addition to one of the cattle corrals and providing arrangements therein for slaughtering swine.

Plans and specifications were prepared and embraced, first, complete system of plumbing and drainage; second, carpenter work; third, masonry and plastering; fourth, construction of concrete floors.

Advertisement was published in the local papers, inviting proposals for the work. The following is an abstract of the bids received:

Name of bidders.	Class of work.						Cement floors, 750 square yards.		Labor on item No. 7.
	Plumbing and drainage. (1)	Labor on item No. 1. (2)	Carpenter work. (3)	Labor on item No. 3. (4)	Masonry and plastering. (5)	Labor on item No. 5. (6)	Per yard. (7)	Total.	(8)
J. W. Cousins	$4,250.00								
A. Brownlee	4,176.97	$1,380.37	$5,626.17	$1,200.00	$1,982.37	$752.00	$1.80	$1,350.00	$0.60
Parker, Waugh & Co.			4,362.75	3,500.00	1,300.00	1,000.00	2.70	2,025.00	1.50
A. E. Muller & Co.	4,800.00								
A. Guzman & Co.			8,320.00		1,189.00		2.85	1,752.60	
M. G. Rioz			6,227.00						
Purdy & Henderson.	2,877.77		4,391.50		2,543.10		1.90	1,425.00	

Contracts were executed with Purdy & Henderson for the plumbing and drainage and concrete floor work, and with R. Guzman for the masonry and plastering. The lowest bid received for the carpenter work was considered excessive, and authority was obtained to carry on this part of the improvements by hired labor.

Upon the request of the mayor of Habana, an estimate was prepared for enlarging the shower-bath building, amounting to $430. This estimate was approved, and the extra plumbing was completed by Purdy & Henderson and the balance of the work was carried on by hired labor. The improvements were completed August 4, 1900, at a cost of $9,269.29, and the buildings were turned over to the mayor and the city authorities August 25.

The following is a description of the most important improvements:

Nine hundred and fifty-six feet of open drains were put in new or repaired. These drains carry away all the rain water from the roof and all the surface water from the grounds surrounding the group of buildings comprising the matadero.

Vitrified drains were laid as follows:

Vitrified pipe:	Feet.
15-inch	398
8-inch	128
6-inch	42
4-inch	96

The 15-inch pipe drains nearly 50,000 square feet of street surface in addition to all the water carried to it through the open drains. The 8, 6, and 4-inch pipes carry

Digitized by Google

SWINE SLAUGHTERHOUSE.

SWINE SLAUGHTERHOUSE, FEBRUARY, 1901.

Digitized by Google

Digitized by Google

HABANA MATADERO. TOILET ROOM.

HABANA MATADERO. SHOWER ROOM.

Digitized by Google

Digitized by Google

away the soil and waste matter from the water closets and shower room, together with all water used in dressing the carcasses of the beef and swine and in washing out the slaughterhouses and corrals.

Cast-iron drains were laid as follows:

Cast-iron pipe.	Feet.
8-inch	223
6-inch	74
5-inch	10
4-inch	123

The 8-inch cast-iron pipe extends under the floor of the beef slaughterhouse and takes the place of the foul plank-covered masonry drain that formerly carried away wash water, blood, and (owing to the large crevices between the plank cover and the cement floor) pieces of flesh and entrails, that upon being dumped into Matadero Creek, decayed and caused pollution. The liquid matter is now carried away through 12 cesspools, with covers of heavy iron grating, that are connected to the 8-inch drain, which has been covered with cement flooring, converting the foul-smelling interior of the slaughterhouse into a clean and odorless building. In like manner the 4, 5, and 6-inch pipes drain the swine slaughterhouse.

Thirty-four self-closing water cocks, to prevent waste of water, have been installed to replace the old compression cocks in the beef slaughterhouse.

At the front of the grounds a lavatory building has been erected, containing 2 water-closets, 1 lavatory, and 1 urinal for the superintendent, and 5 water-closets, 2 urinals, and 1 lavatory for the workmen employed on the grounds.

Adjoining the new swine slaughterhouse a shower-bath room has been erected, containing 32 head showers.

New taps have been made for hose connections, and water pipes have been extended as deemed necessary to the different parts of the grounds and buildings.

One hundred feet of new 2½-inch hose have been furnished for washing the floors of the buildings.

Cement floors have been graded and patched and strainers have been put over yard drains at outlets to sewers.

The buildings and arrangements for slaughtering swine comprise the following:

An addition was made to one of the cattle corrals, inclosing a space 58 feet wide by 59 feet long. On one side of this addition a building covering a space 48 by 52 feet, and containing 7 swine corrals with a capacity for 250 hogs, was built. Each corral is provided with a trough for watering the swine.

In slaughtering the swine, they are driven in limited numbers into a shackling pen, where they are secured by a shackle by the hind leg and hoisted with the aid of a block and tackle to an overhead track, where they are run into the slaughtering room thus suspended. Here they are killed by sticking them in the neck with a knife, and they are then pushed along to a platform, where a gambrel is inserted at the joints of their hind legs and they are hoisted into a scalding vat. Upon being hoisted out of the vat they are again suspended from the track and the hair is scraped from their carcasses. They are then rolled to another point in the room, where their entrails are removed, placed upon a table, sorted, cleaned in a cleaning tank, and prepared for market. After the hog is dressed, he is pushed to the far end of the track and switched on side tracks. A sufficient amount of overhead track has been installed to hold 200 hogs.

The addition in which this killing is done was built of heavy timbers to match the building it adjoins, and is roofed over with galvanized corrugated iron. The building is inclosed by an inclosure 7 feet 6 inches high, and has been floored over with cement flooring blocked off into 5 foot squares.

The building inclosing the corrals is built of lighter material, but is roofed over same as the main building, and is floored with cement flooring blocked off into 3 foot squares.

Attention is invited to the accompanying photographs showing the improvements.

OFFICE OF MUNICIPAL ARCHITECT.

[Mr. Luis de Arozarena, municipal architect.]

The municipal architect is charged with the inspection of all building operations in the city of Habana. Work of improving and repairing various city properties is also carried on under his direct supervision. Applications for permits for constructions of buildings and establishment of industries are made to the ayuntamiento, and referred to the municipal architect for his recommendation. When approved, it is his duty to see that all such work is carried on in conformity with the municipal ordinances.

Digitized by Google

During the six months, 4,458 expedientes have been received from the ayuntamiento, and 4,184 have been dispatched relating to the following works:

New works:	
New buildings	78
Additional stories	16
New rooms	95
Stables	11
Sheds	22
Fences	46
New fronts	16
Partitions	20
Porches	5
Balconies	6
Staircases	6
Dividing walls	7
Bath rooms	7
Show cases	7
Halls	6
Columns	7
Kitchens	7
Ceilings	4
Chimneys	2
Down spouts	2
Sidewalk	1
Gate	1
Skylight	1
Gallery	1
New roofs	5
Sundry minor works	68
	447

Repairs:	
Roofs or floors	278
Doors or windows	112
Whitewashing and painting	217
Staircases	9
Rooms	10
Paintings	17
Fences	16
Partitions	20
Porches	14
Balconies	24
Window grates	15
Drains	17
Water-closets	17
Pillars	8
Walls	8
Dividing walls	5
Cooking furnaces	10
Beams	10
Sidewalks	12
Down spouts	7
Fronts	25
Posts	4
Sheds	8
Connections to sewers	5
Bath rooms	3
Stables	3
Kitchens	2
Show cases	3
Gables	3
Transoms	1
Arches	2
Skylight	1
Ceiling	1
Trusses	4
Yards	2
General repairs, patching, etc	81
	969

Denunciations:	
Works without licenses	244
Wooden structures	70
Ruinous houses for demolition	100
Ruinous houses for repairs	99
Extension of works	22
Unsanitary condition	35
Fences	39
Stables	15
Barbacoas	13
Sheds	14
Fronts	16
Balconies	14
Interrupting thoroughfares	12
Rooms	11

Denunciations—Continued.	
Entrepisos	8
Porches	24
Cornices	8
Ruinous walls	7
Chimneys	6
Staircases	9
Doors and windows	8
Falling down of houses	3
Partitions	6
Kitchens	3
Meat shops	6
Charcoal shops	3
Kiosks	2
Laundry	1
Fruit store	1
Sundries	84
	883

Industrial licenses:	
Grocery stores	43
Laundries	45
Coffee houses	85
Restaurants	39
Fruit stores	89
Dairies	31
Charcoal shops	41
Cigar stores	37
Carpenter shops	18
Hardware stores	6
Boilers, gas, and steam motors, etc	10
Second-hand stores	8
Tin shops	5
Poultry stores	8
Carrousel	6
Pastry shops	13
Transport agencies	5
Lodging houses	21
Meat shops	7
Blacksmith shops	5
Bakeries	9
Wine stores	4
Stables	2
Shoe stores	3
Sundries	126
	666

Finished work:	
New works	211
Repairs	299
Industries	291
Demolitions	20
	821

Reports:	
Building lines	28
Estimates	29
Extension of time	34
Waterworks installation and fraud	45
Plans	81
Complaints	69
Claims	2
Complaints of fees (arbitrios)	10
Sundries	599
	897

DEMOLITIONS.

Houses	29
Partitions	3
Barbacoas	4
Rooms	5
Fence	1
Roof	1
Porch	1
Kitchen	1
Shed	1
Wall	1
Water-closet houses	1
Flat roof battlement	1
	40

Digitized by Google

The following repairs to city properties were finished during the six months:

Colon market.—Plumbing: Installation of 14 wooden water-closets, 11 enameled urinals, 6 galvanized-iron sinks with drains and traps, drain pipes for fish tables. The water-closets were installed in old kiosks, two of which were reconstructed. Water pipes were constructed to two tanks located on the roof.

Marble work: Installation of 35 slabs for meat tables and 8 large slabs for fish tables.

Modification of vegetable tables: Consisted of lining 230 square meters of the vegetable tables.

Third police station.—Consisted of carpenter and masonry work in constructing a forage room, repairing floors, building feed boxes, repairs to water-closet, and whitewashing inside of station. Cost of work, $97.85.

Repairs to lightning rods, maestranza building.—Connecting and repairing lightning rods, and furnishing and installing 38 meters of new rods. Total cost of work, $63.36, of which $35.36 has been paid.

Repairs to skylight, police department building.—Consisted of repairs to frame of skylight and putting in 9 glass panels; repairs to roof and ceiling, and whitewashing; total cost of improvements, $74.75.

Work at dog pound.—Replacing and resetting flagstones, patching and whitewashing walls and partitions, and repairs to doors; cost of work, $65.

Repairs to pavement, Tacon market.—Replacing of 25 flagstones and resetting old stones in different parts of the building, the whole comprising about 70 square meters; total cost, $212.75.

APPENDIX L.

DEPARTMENT OF CUBA, OFFICE OF CHIEF ENGINEER.
Habana, Cuba, January 15, 1901.

SIR: I have the honor to submit my report of operations of the department of works of the port for the six months ending December 31, 1900.

The organization of the department is practically the same as stated in report of fiscal year ending June 30, 1900. The work executed during the period covered by this report is classified under the heads "Reconstruction," "Care and repair of wharves," "Dredging," and "Miscellaneous."

RECONSTRUCTION.

Bulkhead at Capitania del Puerto.—This bulkhead is situated between the Capitania del Puerto and Caballeria wharf and was formerly constructed of wood, much of which had become rotten, rendering the whole structure weak, unsightly, and unsanitary. The project submitted for its reconstruction under date of October 13, 1900, was to construct that portion above extreme low water of concrete in order to give it a more attractive appearance and to be much more sanitary than if rebuilt of wood. The estimated cost of the work was $1,431.56, to be paid for from funds on hand. Authority was granted in second indorsement, Headquarters Division of Cuba, October 18, 1900, file No. 1236 (O. C. E. D. of C., file No. 630). The work was commenced October 22 and completed November 15, 1900. The bulkhead is 160 feet 6 inches long, 2 feet 6 inches wide on top, 3 feet wide at the base and 4 feet high, and contains approximately 75 cubic meters of concrete. There are two sets of steps, one for the use of the Capitania of the port and the Marine-Hospital Service, and the other for the public.

Expenses incurred:	
Labor	$535.13
Material	759.98
Total	1,295.11
Bill of Materials:	
135 barrels cement, at $3.30	445.50
35 meters sand, at $2.20	77.00
47½ meters broken stone, at $2	95.00
4,156 feet pine lumber, at $22	91.43
200 pounds nails, assorted	10.45
3,000 pounds lime, at $0.35	10.50
200 pounds bolts	13.00
6 iron buckets	4.50
6 wheelbarrows	12.60
Total	759.98

Digitized by Google

CARE AND REPAIR OF WHARVES.

Under this head are included the general wharves (Caballeria, Villalta, Aduana Vieja, Carpineti, and San Francisco), Luz, Paula, and Tallapiedra wharves. The work consists of current repairs, such as repairing or renewing floor, floor beams, pile fenders, column protectors, zinc roofing, splicing rotten or useless piles, repairing the pavement adjoining the bulkhead, etc.; for this work a regular crew of several carpenters, laborers, watchmen, and a mason and tinner are employed.

Character and extent of principal repairs:	
Floor beams laid	61
Floor beams repaired	18
Flooring repaired ..... square feet..	9,061
Piles spliced	24
Pile bridles placed	15
Mooring rings placed	6
New column protectors placed	9
Column protectors repaired	12
Wharf border renewed ..... linear feet..	180
Guard posts placed	6
Gutter repaired ..... linear feet..	725
Roofing repaired ..... square meters..	402
Pavement repaired ..... do....	463
Wooden trusses made and placed	4

Expenses incurred:	
Labor	$5,989.25
Material	801.71
Total	6,790.96

Bill of materials:	
1,500 feet hard wood, at $75	112.50
14,465 feet pitch pine, cost from $21.75 to $24; average cost, $22.4636 per M	347.60
44 barrels nails, cost $4.12 to $4.50 per barrel; average, $4.3272	190.40
237 pounds nails, assorted	13.20
12 pile fender straps, at $3.10	37.20
500 pounds No. 12 zinc sheets, at $7.85	39.25
Miscellaneous, paint, brushes, brooms, etc	61.56
Total	801.71

DREDGING.

The principal work done during this period was the continuation of the two projects mentioned in report for last fiscal year: Dredging in the basin for the installation of the proposed dry dock of Krajewski-Pesant Company, at Regla, and dredging in Atares Bay. Several other works of a minor character were executed. Two of the three dredges have been at work almost constantly.

Dredging of navy-yard.—The dredging at this place was done upon request of Lieut. Col. C. F. Humphrey, chief quartermaster Division of Cuba. Authority for the work contained in third indorsement, Headquarters Division of Cuba, dated July 6, 1900 (O. C. E., file No. 351). The object of the dredging was to remove lumps at the coal wharf and in front of the quartermaster's wharf just constructed. The dredge *Puerto Rico* commenced work on July 11, 1900, and finished July 18, 1900, excavating 933 cubic meters, at a total cost of $202.25.

Expense incurred:	
Labor	$116.00
Materials and supplies	18.25
Hired tug, towing to sea	68.00
Total	202.25

Cost per cubic meter, $0.2167.

Dredging at Paula wharf.—This work was performed as per authority contained in third indorsement, Headquarters Division of Cuba, dated July 17, 1900 (O. C. E. D. of C., file No. 378). The cost of the work was paid for from current funds. The object of dredging at this point was to obtain a greater depth approaching and alongside the water pier and lower end of Paula wharf. The dredge *Puerto Rico* began work July 18 and continued until August 7, excavating 1,166 cubic meters of material, consisting of a thin layer of mud, hard clay, and loose stone overlaying solid rock.

Expenses incurred:	
Labor	$375.50
Materials and supplies	51.44
Total	426.94

Cost per cubic meter, $0.3661.

Digitized by Google

CONCRETE BULKHEAD AND STEPS, REPLACING OLD WOODEN STRUCTURE.

Digitized by Google

Digitized by Google

Dredging in Atares Bay.—This work was performed under authority contained in third, fourth, and fifth indorsements, dated August 26, 28, and 30, respectively (O. C. E. D. of C., file No. 6802). The authorization provides for dredging in this vicinity to an average depth of 10 feet, at public expense, for the improvement of navigation and betterment of sanitary conditions; the work to be carried on at times when the dredges are not more urgently needed elsewhere. The dredge *Comercio* started work at this place September 12, 1900, and continued until the 12th day of December, 1900, excavating a total of 42,600 cubic meters, at a cost of $5,407.47.

Expenses incurred.

	Labor.	Materials and repairs.	Total.
Comercio	$2,637.00	$953.78	$3,590.78
Tug Cristina	91[illegible].81	702.88	1,613.69
Hired tug	.....	.....	203.00
Total	.....	.....	5,407.47

Cost per cubic meter, $0.1246.

Dredging channel to and alongside of pier of Krajewski-Pesant Company.—This project consisted of dredging to and along the west side of the pier of the Krajewski-Pesant Company, for the purpose of admitting vessels drawing 15 feet of water to moor at the pier, and was done on application of the interested parties under authority contained in second indorsement, Headquarters Division of Cuba, file No. 4136 (O. C. E. D. of C., file No. 442), they paying the entire cost of the work. The dredge *Comercio* was employed from August 6 to 20 and from August 28 to Sepember 11, 1900. The steam drill was also employed several days on this work.

Work performed:

Excavated by *Comercio*	cubic meters..	7,040
Transported to sea	do....	7,040

Expenses incurred.

	Labor.	Materials and repairs.	Rent of dredge.	Total.
Comercio	$875.00	$100.00	$720.00	$1,695.00
Steam drill	66.04	22.98	.....	89.02
Tug Cristina	400.00	182.03	.....	582.03
Blasting material	.....	100.00	.....	100.00
Total	.....	.....	.....	2,466.05

Cost per cubic meter, $0.35.

Dredging for Krajewski-Pesant Company in basin for proposed dry dock.—Under date of November 18, 1899, Krajewski-Pesant Company, of Habana, made application for the dredging of a basin for the installation of a floating dry dock at Regla, authority for the construction of which had previously been given. A project and estimate of cost was submitted December 11, 1899, recommending that this department be authorized to execute the work on condition that Krajewski-Pesant Company pay all expenses of same. The project was approved in first indorsement, Headquarters Department of Habana, December 16, 1899. Work was started February 8, 1900, and during the time previous to the period covered by this report 13,452 cubic meters were excavated. The dredge *Havana* continued work from the 1st of July to and including December 20, 1900. The *Puerto Rico* worked in the same locality from July 1 to 11 and from August 7 to 10, when she was laid off owing to lack of scow service. The dredge *Comercio* worked from August 21 to 26, inclusive, and from December 12 to 31, inclusive. The steam drill was employed continuously at this place with the exception of a few days in September.

Work performed:

Dredge *Havana* excavated	cubic meters..	10,341
Dredge *Puerto Rico* excavated	do....	1,100
Dredgi *Comercio* excavated	do....	3,700
Total	do....	15,171
Transported to sea	do....	15,171
Holes drilled and blasted	number..	806
Average depth of holes drilled	meters..	2.77
Total depth of holes drilled	do....	2,236.89
Average charge of powder used	pounds..	4.11

Digitized by Google

Expenses incurred.

	Labor.	Material and repairs.	Rent of dredges.	Total.
Dredge Havana	$2,463.94	$801.27	$1,500.00	$4,265.21
Dredge Comercio	652.26	174.24	615.00	1,441.50
Dredge Puerto Rico	188.50	17.14	152.00	357.64
Steam drill	2,245.96	224.50	.....	2,470.40
Department tug, towing to sea	.....	.....	.....	656.36
Hired tug, towing to sea	.....	.....	.....	231.00
Office and superintendence	.....	.....	.....	855.00
Blasting materials (powder and fuses)	.....	.....	.....	818.95
Miscellaneous, duty on dynamite, etc	.....	.....	.....	64.02
Total	.....	.....	.....	11,140.08

Cost per cubic meter, $0.7343. Cost per linear meter for drilling and blasting, $1.50. The cost of this work is high on account of the material being very compact clay and stone, all of which had to be drilled and blasted.

Dredging at Tallapiedra.—On application of the superintendent of street cleaning to dredge in front of the dump board at Tallapiedra to a sufficient depth to permit the largest garbage barges to be fully loaded without grounding, the dredge *Puerto Rico* started work December 28, under authority contained in second indorsement, Headquarters Department of Cuba, December 19, 1900, file No. 1236 (O. C. E. D. of C., file No. 764), and has continued to date, excavating 310 cubic meters.

Expenses incurred:	
Labor	$58.00
Material	29.00
Towing material to sea	16.00
Total	103.00
Cost per cubic meter	$0.3322
Summary of dredging:	
Total quantity dredged by *Comercio* ..... cubic meters..	53,440
Total quantity dredged by *Havana* .....do....	10,341
Total quantity dredged by *Puerto Rico* .....do....	3,509
Total .....do....	67,290
Cost of dredging without transportation:	
Comercio, at $0.1349 per cubic meter	$7,212.57
Havana, at $0.3075 per cubic meter	3,179.70
Puerto Rico, at $0.2402 per cubic meter	843.09
Total	11,235.36
Cost of transportation:	
Department tug *Cristina*	3,302.16
Department tug *Clio*	332.00
Hired tug	483.00
Total	4,117.16
Cost of transportation, per cubic meter	$0.0612
Total expense of dredges	11,235.36
Total expense of transportation	4,117.16
Total cost of dredging	15,352.52
Cost of dredging per cubic meter, including transportation	$0.2282

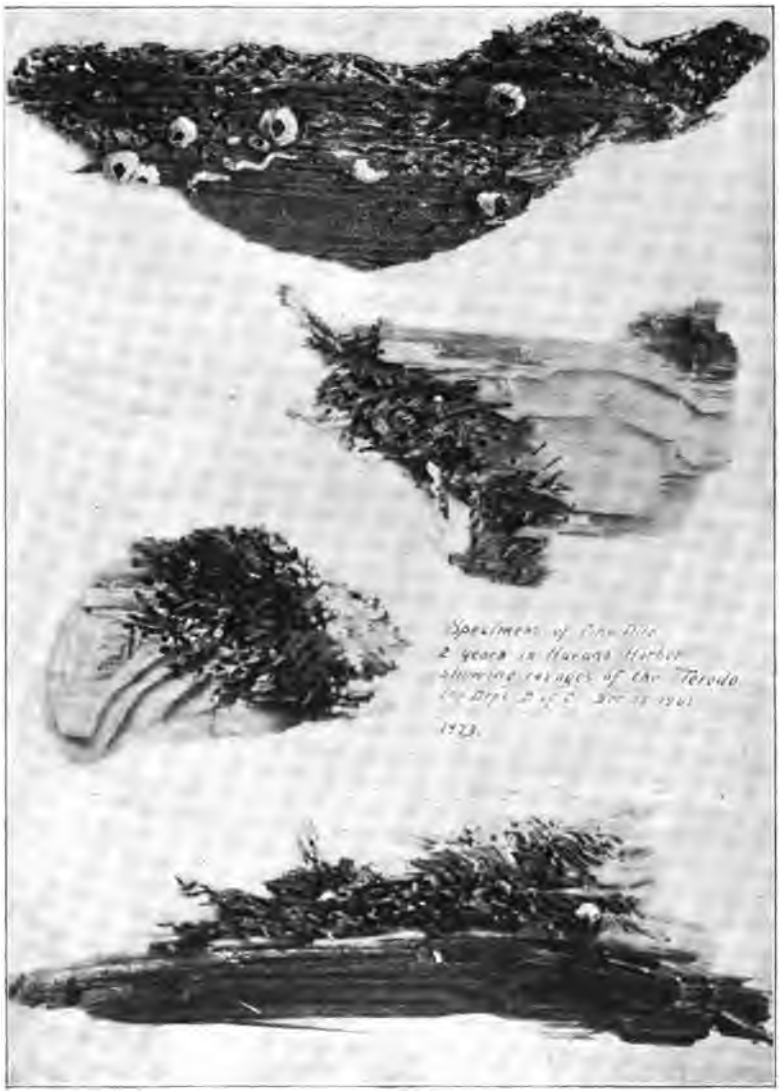
MISCELLANEOUS.

Cleaning harbor front.—A crew of 1 foreman and 8 men with a large rowboat have been regularly employed to patrol the harbor front from La Punta to Matadero Creek and gather up all refuse deposited on the shore.

From two to three trips have been made each week.

Expenses incurred, labor $1,540.00

Digitized by Google



SPECIMEN OF PINE PILE, TWO YEARS IN HABANA HARBOR, SHOWING RAVAGES OF THE TEREDO.

Digitized by Google

Digitized by Google

Plant.—No new plant has been purchased and no very extensive repairs made. The water-tank boat was overhauled and repaired between the dates October 20 and December 5, a number of ribs and most of the siding and deck being renewed, and the hull covered with sheet zinc.

Expenses incurred:	
Labor	$489.00
Material	152.12
Total	641.12
Bill of materials and cost:	
2,575 feet pine, at $24	61.80
550 pounds zinc	48.17
150 pounds nails, assorted	12.20
1 barrel pitch	7.00
15 gallons coal tar	3.75
150 pounds calking paper	9.00
100 pounds oakum	11.00
80 rods, ½ by ¼	3.84
4 washers	.36
Total	152.12

Dredge Comercio.—During the fiscal year ending June 30, 1900, a special allotment of $6,500 was made for the general overhauling and repair of the machinery of this dredge, and the work was well advanced at the close of the fiscal year. There have been expended during the period covered by this report $2,134.30, leaving a balance on hand December 31, 1900, of $725.40.

Tug Clio.—The only repairs of consequence done on this tug was during the month of August, when the machinery was overhauled and several repairs made, amounting to $646.35.

PILES.

The life of different woods in southern sea waters is a very interesting subject, and one upon which authorities differ. It is currently admitted that treated timber—usually by the creosote process—will prolong the life of piles or timbers exposed to the ravages of sea animal life; but the opinion of many is that the additional life will not compensate for the increased cost, and there are those who doubt the virtue of the treatment and who prefer "hard wood" at any price. We have in the government wharf at Triscornia an opportunity of testing this subject. This wharf was built of creosoted pine piles in January and February, 1899, and is therefore just 2 years old. An examination of the piles was made to-day, January 15, 1901, with the following results: Of the total number of piles, 200 to 300, but one shows any evidence of injury from the sea animals. Many of the piles were scraped and thin shavings stripped off, showing the timber to be perfectly sound and thoroughly impregnated with the creosote, which still gives off a fresh, strong odor of the oil. The piles are heavily covered with the animal life, which includes hundreds of forms from the minutest teredo worm to full-fledged oysters and crabs, all of which are intermingled with a plant and coral growth, but the whole seems to be attached to the outside of the piles only, and as yet have done no harm. The one pile referred to as having been attacked presents a fine illustration of the effects of the work of these minute animals, and also shows very plainly that they will work only where the creosote has for some reason not penetrated, and that when they reach the oil they stop. The portion attacked seems to be a strip of sappy wood about 20 inches long by 4 to 6 inches wide and 1 to 3 inches deep. The color of the wood indicates that the treatment did not reach it. The outer edge of the strip is eaten to a pulp, and within it is honey-combed until it resembles a sieve. These piles were treated with 16 pounds of dead oil of coal tar per cubic foot. The quantity usually prescribed is 18 pounds per cubic foot, but in many instances as high as 20 pounds are used.

While the evidence of two years is not sufficient to justify the extensive use of creosoted pine in preference to the native hard wood, it is thought the results are better than at first expected, and are sufficiently encouraging to warrant its moderate use. It is hoped that time will prove beyond question the advantage of the treated pine timber on account of the ease with which it is worked and the very much greater lengths that may be obtained in pine than in the hard wood.

TIDE OBSERVATIONS.

Three tide gauges were established during the fall of 1899 for the purpose of observing the action of the tides and determining the line of mean low tide with a view of adopting this line as the city datum. In the report for the fiscal year ending June

Digitized by Google

30, 1900, this subject was treated to such extent as the records of six months would permit, but as conclusions drawn from a series of observations covering a period of less extent than one year may be questionable, the present report is based on the records of a full year ending December 31, 1900. The three gauges are situated as follows: One at San Lazaro Inlet on the gulf coast, about 1,700 meters west of the mouth of the harbor; one at the Maestranza Building, in the narrow neck of the harbor, 700 meters from its mouth, and one at the extreme upper end of the bay at Tallapiedra wharf. These gauges record the action of the tides at their respective locations and furnish the data necessary for comparison. The curves of all three gauges have been plotted on the same sheets, referred to a straight line temporarily accepted as city datum, which gives a graphic illustration for comparison. Each sheet shows the results of one month's observations, the hours of high and low water, the phases of the moon, and the hour of its greatest declination north or south of the equator. These sheets are too large to accompany this report, but they have served as a basis for the study of this subject. The effect of the wind on the elevation of the water at the different gauges is noticeable, but ordinarily is very slight. For example: When the wind is not very strong and the tide is rising, the gulf gauge will read 0.05 foot higher than that at Tallapiedra or interior gauge, which in turn will read 0.05 foot higher than the Maestranza or channel gauge. The winds with varying force and direction influence the currents and are a cause of greater or less difference in the heights of the gauge readings at the same time, the difference usually being from 0.02 to 0.05 foot, but on the occasion of a very strong northwest wind and an entering current the difference has been as great as 0.30 foot. During time of flooding tide and strong northeast wind a higher level at Tallapiedra results, the difference being about 0.05 foot more than at the gulf, and the time of flood tide is hastened some minutes. With this same wind and an ebbing tide the time of low tide is retarded. A strong northwest wind during time of flooding tide is the greatest factor in producing differing elevations on the several gauges at a given time. Under these conditions the gulf will show 0.20 foot higher than the interior, and the latter 0.20 foot higher than the channel gauge. If the wind continues for 20 to 24 hours the three curves will become almost parallel and the time of high and low tides become identical at each of the three gauges.

As a rule the difference in elevation of the three gauges at a given time is less in an ebbing than with a flooding tide, the difference being usually less than 0.02 foot. The curves in this particular are at times confusing; the usual order observed is that the gulf is 0.02 foot higher than the channel, which is 0.02 foot higher than the interior. The greatest difference in ebbing tide is with a southeast wind, while with a soft northwest wind the heights equalize. Taking into account the varying conditions of wind and current which determine these variations, the average differences may be said to be not more than 0.05 foot, and a general comparison of the readings at the three gauges shows their heights to be almost the same.

The sinuous curves found in the interior and channel gauges are caused by the wind temporarily retarding or accelerating the tidal flow, depending upon its force and the duration of its impulses. An inspection of the curves will show that the range of tide is greater at Tallapiedra than at Maestranza, which in turn is greater than at San Lazaro. As the tidal interval is subject to slight variations at the three gauges, it would be expected that the relation of height to time (or average rate of tidal rise or fall) would not be subject to a rule, but this is not the case. The range in Tallapiedra being greater than at Maestranza and San Lazaro, the rate is consequently greater. As the range of the tides do not exceed 2.50 feet, the average rate is very small. It is greater at Tallapiedra than at Maestranza, which is equal to or greater than at San Lazaro. The mean average rate at Tallapiedra is 0.17 foot per hour; in Maestranza, 0.12, and in San Lazaro 0.10. The greatest rate shown in Tallapiedra was 0.27 foot.

Difference between successive and alternate tides: We have taken as basis for the following observations those tides observed at San Lazaro gauge, as the same rule applies to the Tallapiedra and Maestranza tides. The phenomenon of the tides in Habana, strictly speaking, obeys the general laws of tides accepted in the equilibrium theory of tides. We say "strictly speaking" because sometimes the tides are so small that they could not be observed were it not for the delicacy of the tide gauges. These general laws are: First. Two high waters and two low waters occur during each twenty-four or twenty-five hours. This phenomenon exists in Habana. The type of our tropic tides is indicated by highest high water to lowest low water and lowest high water to highest low water, as may be seen in Diagram B, which represents the tropical "spring tides" of the 28th and 29th of May, 1900 (date of total eclipse of the sun). The greatest Great Tropic Range of the year occurred the 29th of May, being 2.22 feet. In the Diagram B, in comparing the semidaily ranges, we observe

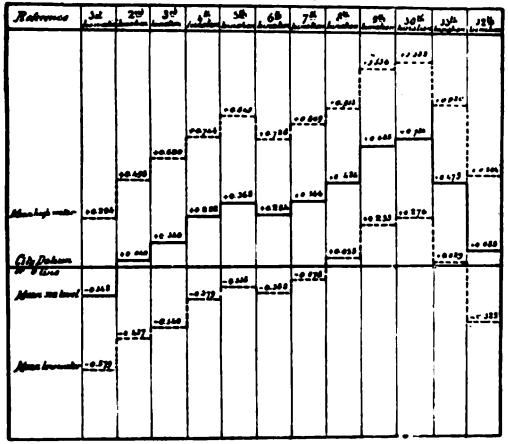
Digitized by Google

Digitized by Google

Digitized by Google

Diagram showing variations in Mean sea level
Mean high water and Mean low water
for periods of one lunation from Jan 3rd to Dec 31st 1900.

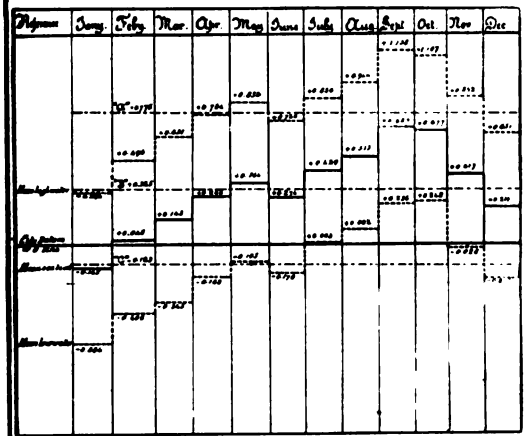
San Lázaro (Gulf) Gauge



"C"

Diagram showing monthly variations
in Mean sea level. Mean high water and mean low water, from
January 1st 1900 to December 31st 1900.

San Lázaro (Gulf) Gauge.



A, B, C, are mean values for High water, Low water and Mean sea level
obtained from observations of one year

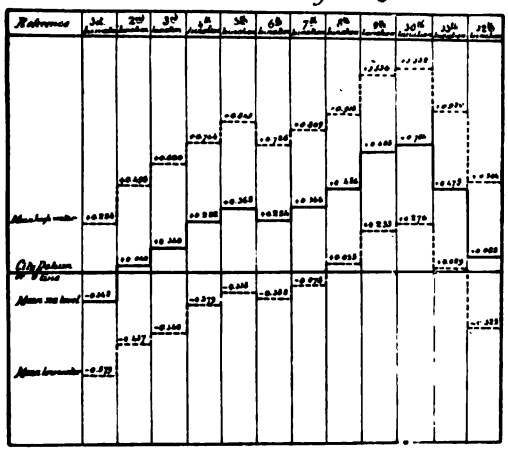
D

Digitized by Google

Digitized by Google

Diagram showing variations in Mean sea level
Mean high water and Mean low water
for periods of one lunation from Jan. 31st to Dec. 31st 1900.

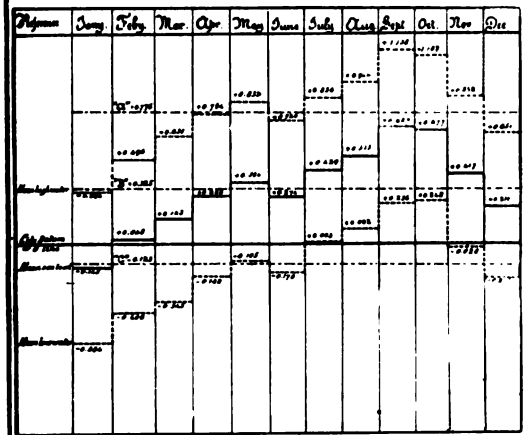
San Lázaro (Gulf) Gauge



"C"

Diagram showing monthly variations
in Mean sea level, Mean high water and mean low waters, from
January 31st 1900 to December 31st 1900.

San Lázaro (Gulf) Gauge.



A, B, C, are mean values, for High water, Low water and Mean sea level
obtained from observations of one year

D

Digitized by Google

Digitized by Google

Project for Gulf and Harbor Avenues and Sea Walls, Havana.

From Torreon of San Lazaro on the West to Fuerza on the East.
Reclaimed areas shown by shading.
Prepared by Engineer Department,
Department of Cuba.

Digitized by Google

Digitized by Google

Section of Harbor Avenue

Showing portion of Old Wall to be Left as a Monument, Entrance to Public Square, and Portion to be Removed.

Section of Harbor Avenue,

Showing portion of the Wall to be removed.

Digitized by Google

Digitized by Google

that the first is 2.20 feet and the second but 0.40 foot. It is necessary to consult the gauge records to appreciate a tide of this height. Second. The heights of alternate tides are more or less unequal. We know by the equilibrium theory of tides that the sea surface assumes the form of an ellipsoid of revolution whose longest axis points toward the tide-producing body. The different positions which the ellipsoid takes are caused by the declination of the moon, or by its being on the equator, two consecutive tides being nearly equal when the moon is in the equator and becoming more unequal at time of moon's greatest declination either north or south. The tides called tropic tides are caused when the moon is farthest north or south, which is 21° or 22°, or near the Tropics. Having this law in mind, and the very small semidiurnal range of our tropic tides, the phenomenon which occurred on the 8th, 9th, and 10th days of July is easily explained, as shown in Diagram A. The moon was then at its greatest declination south, and the sun had passed the zenith on June 30, which was about its greatest declination north. In Diagram A it can be seen that the semidiurnal range was reduced to 0. During the lunations of August, January, and February it was proved that with analogous positions of the sun and of the moon the same phenomenon occurred to a less degree, the semidaily ranges being exceedingly small, 0.06, 0.05, and 0.02 foot. It will be observed this phenomenon did not occur in the interior and channel gauges, but probably would have done so if the wind and current had not entered as opposing factors. Third. The heights of corresponding tides vary from day to day. This phenomenon takes place also in Habana, and is caused: First. Lunar variation. When the attraction of both the sun and the moon are present at the same time, as in new or full moon, it is natural that the highest tides occur, and as the moon nears the quadrants the tides become less, as the attractions of sun and moon are directly opposed, during which time the tides are smallest. Second. Annual variation, which is caused by the greater or lesser attraction of the sun which may be seen in Drawing D, resulting in the mean sea level compared by months becoming higher nearing the equinoxes and lower nearing the solstices.

The following laws also are complied with in this port: The lunitidal intervals are shorter than usual near the times of first and fifth octants and longer near the times of third and seventh. The inequality in intervals and height for alternate tide becomes greater as the moon's declination either north or south increases. (Second law.) The range of tide is greater near the time of new or full moon, and lesser near the moon's quadratures. (Lunar variation.) The range of tide is greater also near the time when the moon is in perigee and lesser when it is in apogee. Finally, from the observations during the past year, we have been able to reduce as a mean value for the establishment of the port during new or full moon of 8 hours 14 minutes.

Table deduced from observations at San Lazaro (Gulf) gauge.

Date.	Mean range.	Maximum range.	Minimum range.	Maximum difference in water.	Mean sea level referred to city datum.
1900.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
January	0.878	2.05	0.05	2.37	0.145
February	.908	1.76	.05	2.18	.045
March	.976	1.91	.06	2.28	.143
April	.952	2.18	.06	2.62	.288
May	.937	2.22	.12	2.28	.363
June	.908	2.20	.14	2.20	.274
July	.858	1.90	.02	1.96	.429
August	.861	1.73	.07	1.84	.513
September	.902	1.78	.04	2.16	.687
October	.859	2.00	.12	2.10	.677
November	.891	2.19	.24	2.39	.417
December	.870	1.97	.17	1.99	.216

Mean range for the year, 0.898; maximum range during the year, 2.22; minimum range during the year, 0.02; mean sea level deduced from observations of the year, 0.325.

Digitized by Google

Table deduced from observations at San Lazaro (Gulf) gauge.

Date.	Mean high water referred to city datum.	Mean low water referred to city datum.	Highest high water referred to city datum.	Lowest low water referred to city datum.
1900.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
January	0.294	0.564	1.26	1.11
February	.496	.406	1.22	.96
March	.631	.345	1.42	.86
April	.764	.188	1.72	.90
May	.832	.105	1.76	.52
June	.726	.176	1.54	.66
July	.856	.003	1.60	.36
August	.944	.082	1.60	.24
September	1.138	.236	1.86	.30
October	1.107	.248	1.96	.14
November	.862	.028	1.90	.49
December	.651	.219	1.41	.56

Mean high water deduced from observations of one year	0.775
Mean low water deduced from observations of one year	.123
Highest high water during the year	1.96
Lowest low water during the year	1.11
Maximum difference in water level	3.07

The following project for the improvement of the harbor front was submitted January 24, 1901, and forwarded to headquarters of the department with the indorsement of the chief engineer, as quoted below:

SIR: Complying with your verbal instructions, I have the honor to submit herewith a project for the improvement of the harbor front between La Punta and Capitania del Puerto. The object of this project is: (1) To correct the sanitary conditions, which are bad on account of the accumulation of refuse and foul deposits due to the angles in the present shore line; (2) to provide a broad and unobstructed roadway between the north end of the Prado and the Palace, post-office, and Caballeria wharf; (3) the reclamation of a large tract of land, which will be at the disposition of the city for parks, driveways, small-boat landings, wharfage for light-draft vessels, and storage yards for materials and merchandise; (4) the general beautifying of the city front, which will enhance the value of taxable adjacent property.

The project includes the construction of a concrete sea wall carried on easy curves from the Punta to the Capitania del Puerto in water ranging in depth from 3 to 11 feet, an average of about 7 feet; the filling in back of the wall to the street level with material such as broken stone, cement, mortar, etc., from old building, and sand clay or clean harbor dredgings brought in on barges; the construction of a broad cement sidewalk and a macadam carriage road; the removal of the old sea wall on Cuba street between La Maestranza and Baluarte de la Punta, and the parking of all the angles and reclaimed ground. The carriage road will extend from La Punta to the east end of the Cortina de Valdes, where it will enter Empedrado street. The sidewalk will extend the entire length of the sea wall. There will be four sets of steps leading from the sidewalk to the water for the accommodation of small boats. The landings for light-draft vessels will be located, one near La Punta and the other near the foot of Empedrado street.

Your attention is respectfully invited to the accompanying map, showing the proposed work in plan and section, and to the attached estimates, which are approximate, being based upon uncertain soundings and without borings, but which are sufficiently close to give a very fair idea of the cost of the scheme. The work of parking is not included in the estimate, as this will be done by the department of parks from current allotment.

One estimate is for a foundation composed of rough-cut stone and riprap and the other is for a concrete foundation, the concrete to be deposited in sacks and laid in place by a diver. The latter plan will dispense with the wooden stringers and ties and also with the pile construction at the landing for vessels, as the slope of the concrete will be materially steeper than that of the loose stone and permit the vessels to lie close up. The whole project should be subject to such slight modifications as the chief engineer may determine.

Digitized by Google

Estimate of materials and cost of project for improving harbor from La Punta to the Capitania.

Sea wall, fill, roadway, and sidewalk, loose-stone foundation:	
2,200 cubic meters concrete in place, at $11	$24,200.00
800 cubic meters dressed stone removed from Cuba street wall and placed by hand in foundation, at $2	1,600.00
1,200 cubic meters rough-dressed stone in place, at $6	7,200.00
7,000 cubic meters riprap stone in place, at $3	21,000.00
90,000 feet B. M. native hard-wood timbers in place, at $110	9,900.00
20,000 feet B. M. native hard-wood sheet piles, at $110	2,200.00
30,000 feet B. M. yellow pine for molds, at $30	900.00
24,000 feet B. M. yellow pine for platforms in place, at $50	1,200.00
5,000 pounds bolts, nails, spikes, etc., at $0.07	350.00
120 Jucaro piles 10 meters long in place, at $21	2,520.00
62,000 cubic meters fill, using some sweepings, sewer excavation, refuse, and some harbor mud, at $0.75	46,500.00
480 iron pile points, at $1.50	720.00
4,200 square meters cement sidewalk, at $1.50	6,300.00
9,000 square meters macadam carriage road, at $1	9,000.00
Extending sewers and drains	3,000.00
	136,590.00
Contingencies, 15 per cent	20,488.50
Total	157,078.50

Estimate of materials and cost of project for improving harbor front from La Punta to the Capitania.

Sea wall, fill, roadway, and sidewalk, all concrete foundation:	
2,200 cubic meters concrete in place in wall, at $11	$24,200.00
5,500 cubic meters concrete in place in sacks in foundation, at $8	44,000.00
30,000 feet B. M. yellow pine for molds, at $30	900.00
24,000 feet B. M. yellow pine for platform in place, at $50	1,200.00
2,000 pounds nails, spikes, etc., at $0.07	140.00
62,000 cubic meters fill, using some sweepings, sewer excavation, refuse, and harbor mud, at $0.75	46,500.00
4,200 square meters cement sidewalk, at $1.50	6,300.00
9,000 square meters macadam carriage road, at $1	9,000.00
Extending sewers and drains	3,000.00
60,000 sacks, at $0.15	9,000.00
	144,240.00
Contingencies, 15 per cent	21,636.00
Total	165,876.00

Respectfully submitted.

A. H. WEBER,
Assistant Engineer, Superintendent Harbor Works.

Maj. WILLIAM M. BLACK,
Corps of Engineers, U. S. A., Chief Engineer, Department of Cuba.

[First indorsement. Department of Cuba, office of chief engineer, January 24, 1901.]

Respectfully forwarded to headquarters Department of Cuba. The necessity for the improvement upon which the project within was made has been impressed upon me ever since my assignment to duty in Habana, and next to the project for bulkheading the head of the harbor, this work is believed to be one of the most important improvements of the harbor front of Habana. The cost is not very great when the advantages to be gained are considered, and it would seem to me to be well to include this item in the amount of money to be raised by the city of Habana under a loan for sewers and paving. The work could then be constructed under contract, if so desired. If there are other revenues which can be applied to this purpose, the immediate approval of the project and the authorization to do the work by hired labor or contract, as may be deemed most advisable, is recommended. The second of the two estimates, that of $165,876, will, it is believed, afford the most permanent work. Should this work be done by contract, it is probable that the cost, including the contractor's profit and the necessary supervision, would be $200,000.

W. M. BLACK,
Major, Corps of Engineers, U. S. A.,
Chief Engineer, Department of Cuba.

Note, March 20, 1901.—A project has just been prepared by the department of streets for extending the present sea wall at the foot of the Prado to the Torreon of San Lazaro, with a driveway, sidewalks, and parking, all as shown on accompanying photographs. The cost of this work is estimated at $309,206. This cost could be reduced to $199,462 if the work were done during the construction of the proposed sewer system, by making use of the excavations from this work for filling.

Digitized by Google

Attention is respectfully invited to the urgent necessity of improving the upper end of the harbor known as Atares Bay. The necessity for this work exists on account of the very bad sanitary condition of this section of the city front and the need of additional wharfage facilities, which could be provided in connection with the general improvement of this locality. A detailed project for this work has not yet been prepared, but it may be stated in a general way that the plant should include a bulkhead from the gas company's property across the low ground at the mouth of Matadero Creek to Atares Hill, the filling in back of the bulkhead to the street level, and the dredging of the bay in front.

Summary of receipts and expenditures:

Receipts—		
Received by regular allotment		$41,361.98
Received by special allotment for repairs to dredge *Comercio*		2,859.70
Received from miscellaneous sources		15,980.77
		60,202.45
Expenditures:		
Office and superintendence		4,905.81
Dredges		13,285.26
Tugs		7,546.37
Tug hire		483.00
Repairs to water boat		641.12
Rent of water boat		224.00
Current repairs to scows and pile driver		639.25
Wharf reconstruction		1,295.11
Wharf, care and repair		6,910.26
Cleaning harbor front		1,540.00
Drillers		3,011.21
Blasting material		971.87
Miscellaneous		723.77
Total		42,177.08
Payments made on liabilities brought forward July 1	$7,207.31	
Returned to treasurer	1,457.10	
Deposited with treasurer for rent of dredges	2,967.00	
		11,631.41
		53,808.44
Balance on hand December 31, 1900		6,394.01
		60,202.45

In addition to the above, all of which pertains to the port of Habana, the following papers have been prepared and submitted during the period covered by this report:

Report on project submitted by the secretary of public works for the improvement of Cardenas harbor; report on proposed rules and regulations governing width of tires for vehicles; report and estimate on the installation of a vault at post-office; report and estimate on the improvement of Cienfuegos harbor; plans and specifications for shed for wharf at Trinidad; report upon proposed addition to the building used by the school of painting and sculpture, Habana; suggestions regarding title of certain government lands at Las Animas; inspection and report upon road at Columbia Barracks; report and estimate on the improvement of Matanzas Harbor; report on the construction of a sea wall and carriage drive from La Punta to Capitania del Puerto, Habana; report on contract for tile floor in penitentiary, Habana.

Very respectfully, your obedient servant,

A. H. WEBER,
Assistant Engineer, Superintendent Harbor Works.

Maj. WILLIAM M. BLACK,
Corps of Engineers, U. S. A.,
Chief Engineer, Department of Cuba.

APPENDIX M.

OFFICE OF CHIEF ENGINEER,
ENGINEER DEPARTMENT, DEPARTMENT OF CUBA,
Habana, Cuba, January 12, 1901.

SIR: I have the honor to submit a report of operations of department of sanitation and renovation of public buildings and fortifications for the period of six months ending December 31, 1900. Much time, trouble, and culling have been expended in obtaining a harmonious and efficient organization susceptible of expansion to meet unexpected work as it arises.

Digitized by Google

The organization as it stands at present consists of three divisions:

(1) The drafting division, in charge of Mr. George W. Armitage, architect, where all plans, estimates, and bills of material are prepared before work of construction is commenced. Three very excellent architects and draftsmen are connected with this department, who have had large technical training, namely: Mr. T. Ernest Videtto, Mr. J. A. Vautier, and Mr. J. A. Tieman. The other employees are Mr. Jose Gonzalez Salas and Mr. Corliss See. To this division much of the results of actual construction are due.

(2) The office division, in charge of Mr. J. L. Young, where all requisitions, reports, and records are made and correspondence attended to.

Mr. J. L. Scrivener has charge of the details of the office, assisted by Mr. Gabriel Ramos and Mr. J. P. Roche. Stenographers are Mrs. Ella Rose-Johns and Miss Carrie L. Rector.

(3) In the construction division work is specialized under competent foremen as much as possible to secure best results, with two general foremen to oversee operations on one or more jobs, and a civil engineer to do the work pertaining to his profession. Following are the foremen, etc.: W. O. Ayer, civil engineer; Elmer Weich, rodman; F. W. Piel and M. M. Latta, general foremen; D. W. Shea, mechanical and electrical engineer; J. W. Cousins, plumbing foreman; Frank Hawker, mason and plasterer foreman; Martin Fuhn, carpenter foreman; H. G. Moore, painter foreman; F. Trowbridge, sewer and excavation foreman; C. P. Greer, A. C. Lavelle, and Alex Browning, assistant general foremen; C. C. Converse and A. Brownlee, inspectors; Alex Rogers and Harry J. Leonard, cost clerks; Frank Chambers and C. W. Stewart, timekeepers.

The foremen of the different classes of work do their particular work under general direction of general foremen as to relation and connection with other classes of work, but the latter do not interfere with their forces.

It has been the endeavor to keep costs up to date in order to intelligently direct operations to avoid wastes and leakages, but a good cost clerk is a rare individual in Cuba, and the present incumbents are the "survival of the fittest."

The splendid photographs showing the work at the different stages of operation, and all the plans and details, were made by Mr. Charles E. Doty, official photographer, engineer department, and are the principal features of this report.

Very respectfully, your obedient servant,

T. L. HUSTON,
Assistant Engineer, Department of Cuba.

Maj. W. M. BLACK,
Corps of Engineers, U. S. A.,
Chief Engineer, Department of Cuba.

DRAFTING FORCE.

A drafting force of 6 men are kept constantly at work preparing projects, getting out plans and specifications, preparing estimates and bills of materials. Since July 1, 1900, the following plans have been produced at costs given:

	Number of sheets.	Cost of drawings.	Amount of estimate for work.	Per cent of estimate required to produce drawing.
Santiago school	30	$972.05	$50,705.80	1.9
Passenger landing	24	464.75	42,000.00	1.1
Dragones barracks	16	215.80	15,858.54	1.4
Mercedes hospital	28	699.40	33,419.64	2.0
Atares castle	15	478.40	22,100.00	2.2
Vivac court room	33	345.15	5,503.82	*6.2
Audiencia improvements	30	154.05	16,500.00	1.0
Quarantine barracks	10	211.90	31,759.25	.7
New laboratory	15	827.45	28,205.00	2.9
Art studio	3	91.65	5,000.00	1.8
La Fuerza	17	889.40	33,846.00	2.6
Tank tower at Cabana	2	29.90	3,982.61	.7
Carcel office	4	87.10	2,570.00	3.4
Miscellaneous drawings	30	160.80	.....	.....

*This included complete drawings and bill of materials for two projects.

Total amount of estimates	$291,450.66
Total amount expended for drawings	$5,617.80
Average per cent of estimate required to produce drawings	1.9

Digitized by Google

During the past two years measured drawings have been made of a large majority of the public buildings throughout the city, which, together with the plans of all new projects, are kept on file in this office.

The following is a list of drawings of public buildings of which no plans existed that have been made from measurements taken since the American occupation: Habana carcel, presidio, presidio infirmary, hospital militar, cuartel de la fuerza, matadero, Mercedes hospital, Atares castle, Dragones barracks, municipal vivac, police headquarters at Casa Blanca, charity hospital at Guanabacoa, laboratory buildings, rural-guard barracks at Guanabacoa, maestranza building, engineer headquarters, Tacon 1, 3, 5, Mercado de Tacon, Cabana fortress, beneficencia, San Lazaro hospital, Reina battery, Compostela street Orphan Asylum, quinta de higiene, hacienda building, post-office building (old), Aldecoa hospital, Recogidas prison, Casa de viudas, carcel at Guanabacoa.

In addition to the above, old Spanish plans of many buildings have been collected and are to be found in the file case of this office.

CARCEL AND AUDIENCIA.

Estimate No. 1, for system of sanitary plumbing, sewers, concrete floor in main patio, steam laundry, cooking apparatus, and sundry repairs, $36,673. Project approved in Civil file D. of C., No. 1236, April 10, 1900; O. C. E. file D. of C., No. 125, April 10, 1900. Estimate No. 2, for additional concrete floors in corridors and main patio, $1,200; project approved in Civil file D. of C., No. 5007; O. C. E. file D. of C., No. 125. Estimate No. 3, for renovation and remodeling of the principal office of the Habana carcel, $2,570. Project approved in Civil file D. of C., No. 1236, November 14, 1900; O. C. E. file D. of C., No. 125–96, November 16, 1900. Estimate No. 4, for the renovation and ornamentation of the audiencia offices and court rooms, this being the civil and criminal court of Habana, $16,500. Project approved in Civil file D. of C., No. 1236, November 13, 1900; O. C. E. file, No. 683, November 14, 1900. Estimate No. 5, for gas and electric system of lighting carcel, $1,770. Project approved in Civil file D. of C., No. 3667, December 20, 1900; O. C. E. file D. of C., No. 125–97, December 20, 1900.

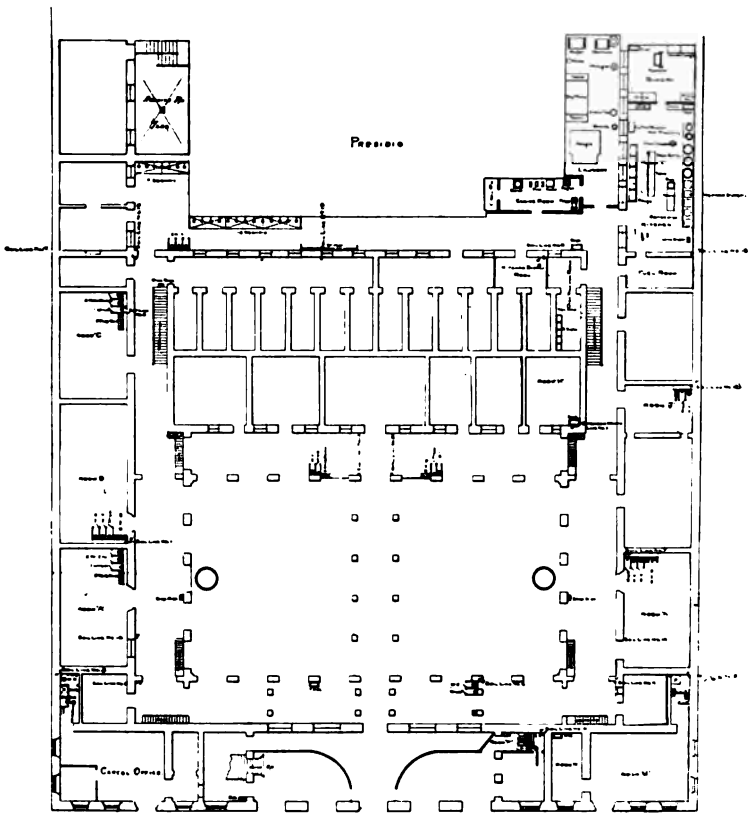
On the 5th day of June, 1900, bids were received according to plans and specifications previously prepared for a new system of plumbing, a steam laundry, steam kitchen, and cement floors. Carpenter work, masonry, and tinwork were done by the department. Prosecution of the sanitary work at the carcel developed the fact that there was originally very little plumbing of any kind, and that was in an extremely unsanitary condition. The water pipes were in bad condition, some completely closed and others broken. Water-closets in audiencia were mostly broken and very filthy. In the carcel, a bucket system had been in use for some time. The sewers were in an awful condition, rectangular, built of brick and stone, half filled with fecal matter and the sewage oozing through the sides saturated the ground for many feet around. Numerous large openings were to be seen directly over sewers in patios, kitchen, and laundry without traps or coverings of any kind. Swarms of rats chased each other through the sewers, aiding materially in keeping them from becoming clogged. At night the rats feasted on the garbage which was thrown around promiscuously after meals. With the old system the rats were a blessing in disguise.

The slow progress of the work necessitated a large amount of disinfectants, as the ground excavated for sewer was very foul and had to be kept continually covered with lime and soaked with electrozone and other disinfectants. About 45 yards of the sewer excavation in laundry was so permeated with sewage that it was removed from the premises, taken to the scows and dumped into the sea. Two circular cement basins and 1 cement tub in laundry answered as combination bath tubs, laundry tubs, and sinks for washing dishes.

The kitchen was a crude affair, consisting of about 10 large iron kettles set in brickwork. No effort was made to carry smoke away through flues.

Purdy & Henderson were the contractors for the steam kitchen and bakery, and much credit is accorded them for being the first contractors for the department who prosecuted their work promptly and satisfactorily. The progress on the steam laundry was very slow, the principal delay being caused by the arrival of a boiler falling short of requirements of specifications as to capacity. The floors in patios, corridors, laundry, and kitchen were in a very dilapidated condition; partly cobblestone, partly old marble tile, and partly flagging. This work was done very unsatisfactorily as a whole. While the material used was good, about 80 yards had to be taken up on account of inferior workmanship. The contractors had many difficulties to contend with—from the difficulty to obtain competent foremen—on account of the condition of building and the proclivity of the prisoners to damage work.

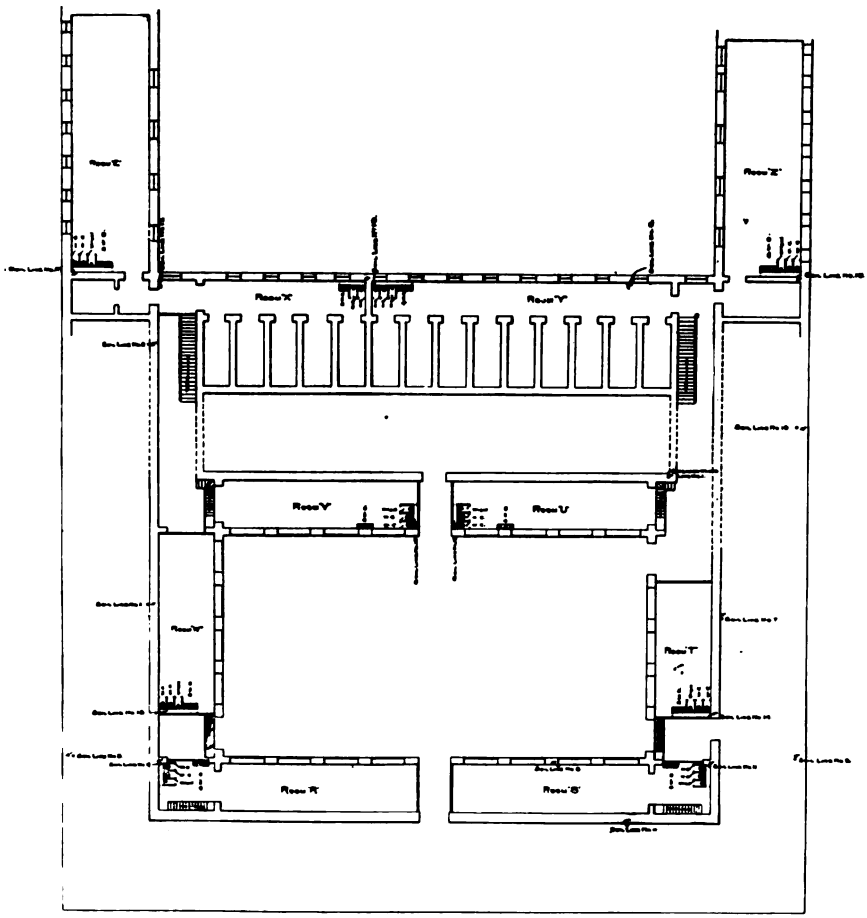
Digitized by Google



FIRST FLOOR PLAN
OF THE
CARCEL
OFFICE OF CHIEF ENGINEER

Digitized by Google

Digitized by Google

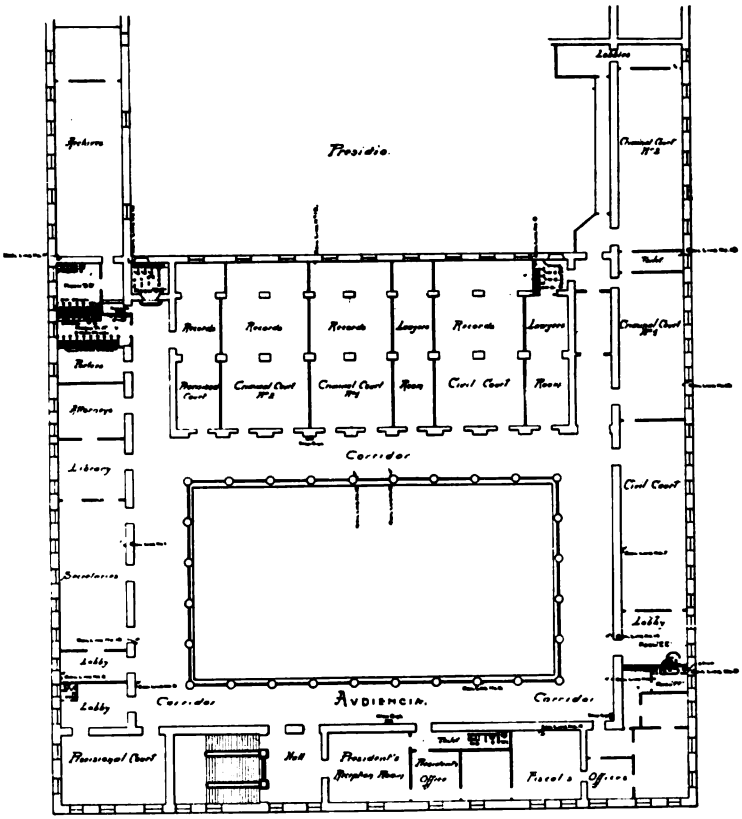


ENTRESUELOS PLAN
OF THE
CARCEL
OFFICE OF CHIEF ENGINEER

No 1661 2/24

Digitized by Google

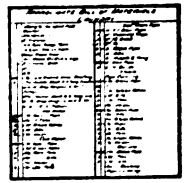
Digitized by Google

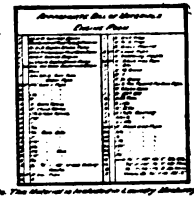


SECOND FLOOR PLAN
OF THE
CARCEL

No 1660

Digitized by Google





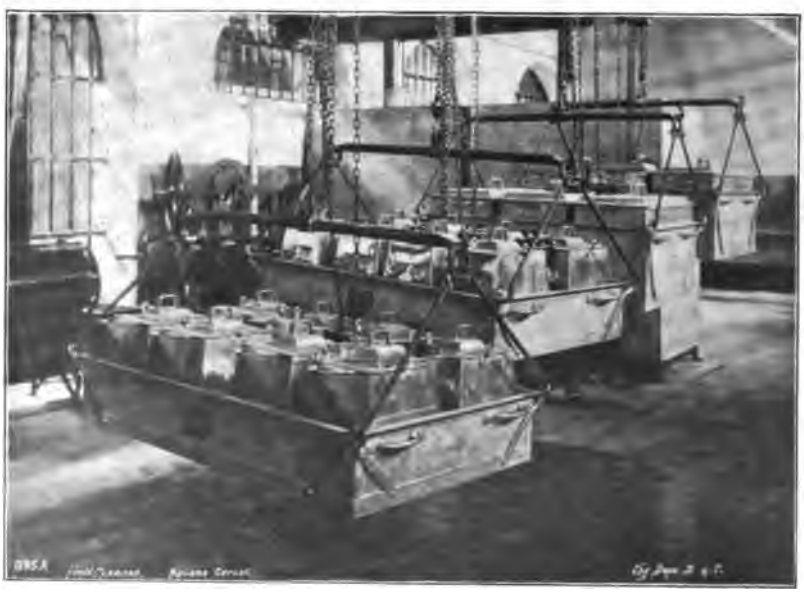
Plan of

KITCHEN, BAKERY, LAUNDRY, ETC.,

Digitized by Google

Digitized by Google

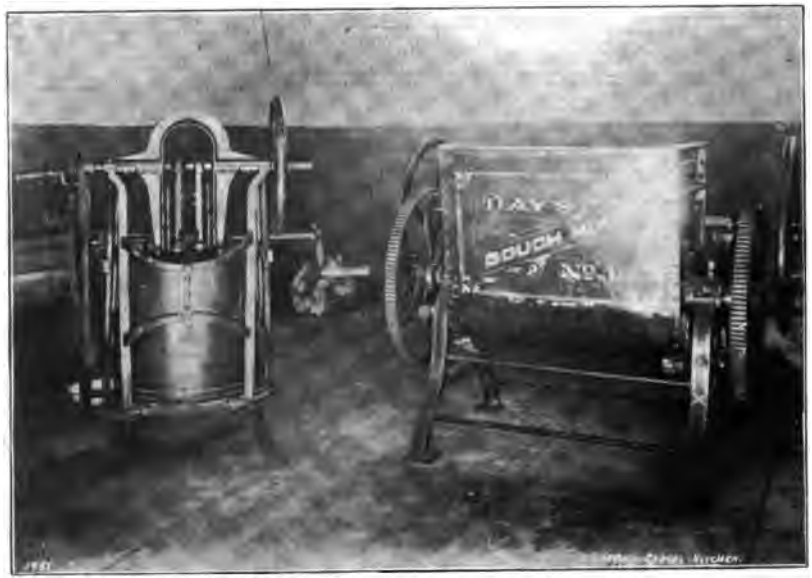
HABANA CARCEL. KITCHEN.



HABANA CARCEL. FOOD CARRIERS.

Digitized by Google

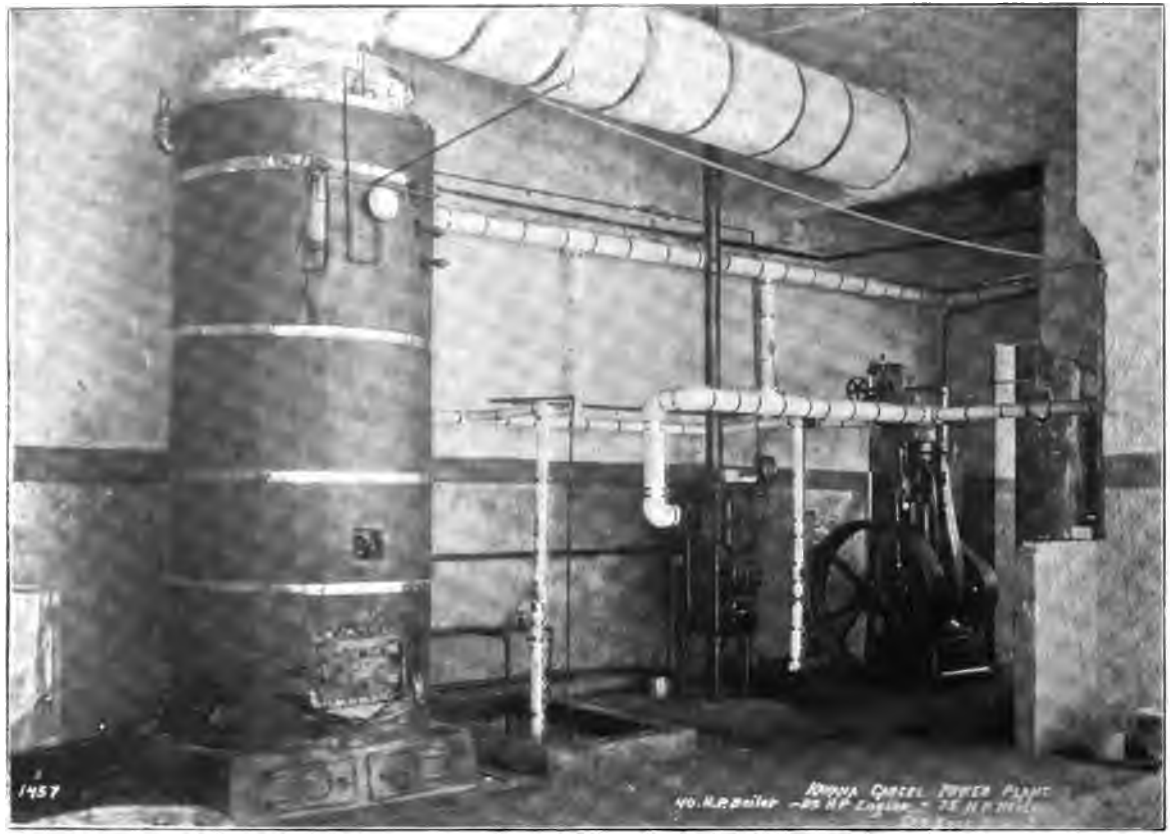
Digitized by Google



HABANA CARCEL. MEAT CHOPPER AND DOUGH MIXER.

Digitized by Google

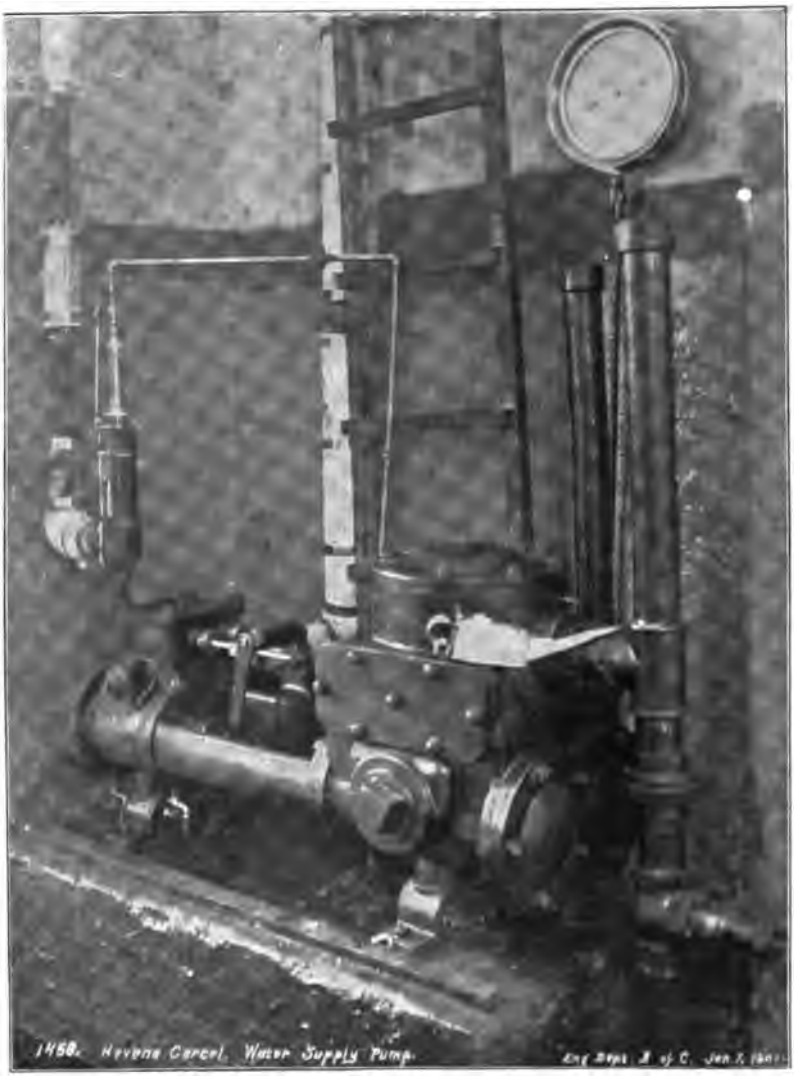
Digitized by Google



HABANA CARCEL POWER PLANT. 40-HP. BOILER, 25-HP. ENGINE, 75-HP. HEATER.

Digitized by Google

Digitized by Google

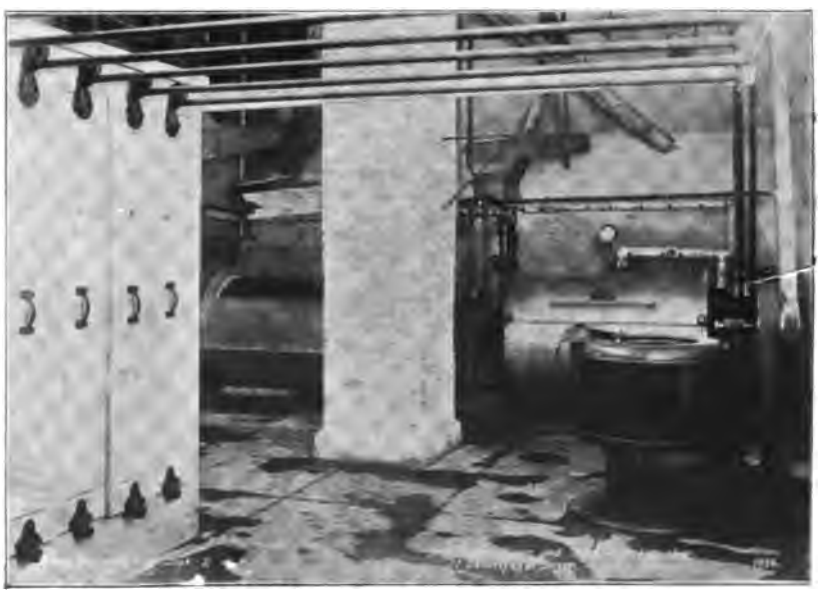


HABANA CARCEL. WATER-SUPPLY PUMP.

Digitized by Google

Digitized by Google

HABANA CARCEL. STEAM LAUNDRY.



HABANA CARCEL. ONE STERILIZER AND WASHER, ONE WASHER, ONE CENTRIFUGAL DRYER, ONE DRY ROOM.

Digitized by Google

Digitized by Google

HABANA CARCEL. SHOWERS.

Digitized by Google

Digitized by Google

HABANA CARCEL. SLOP SINK.

HABANA CARCEL. "ROUGHING IN" TWO WATER-CLOSETS, ONE URINAL, THREE BASINS.

Digitized by Google

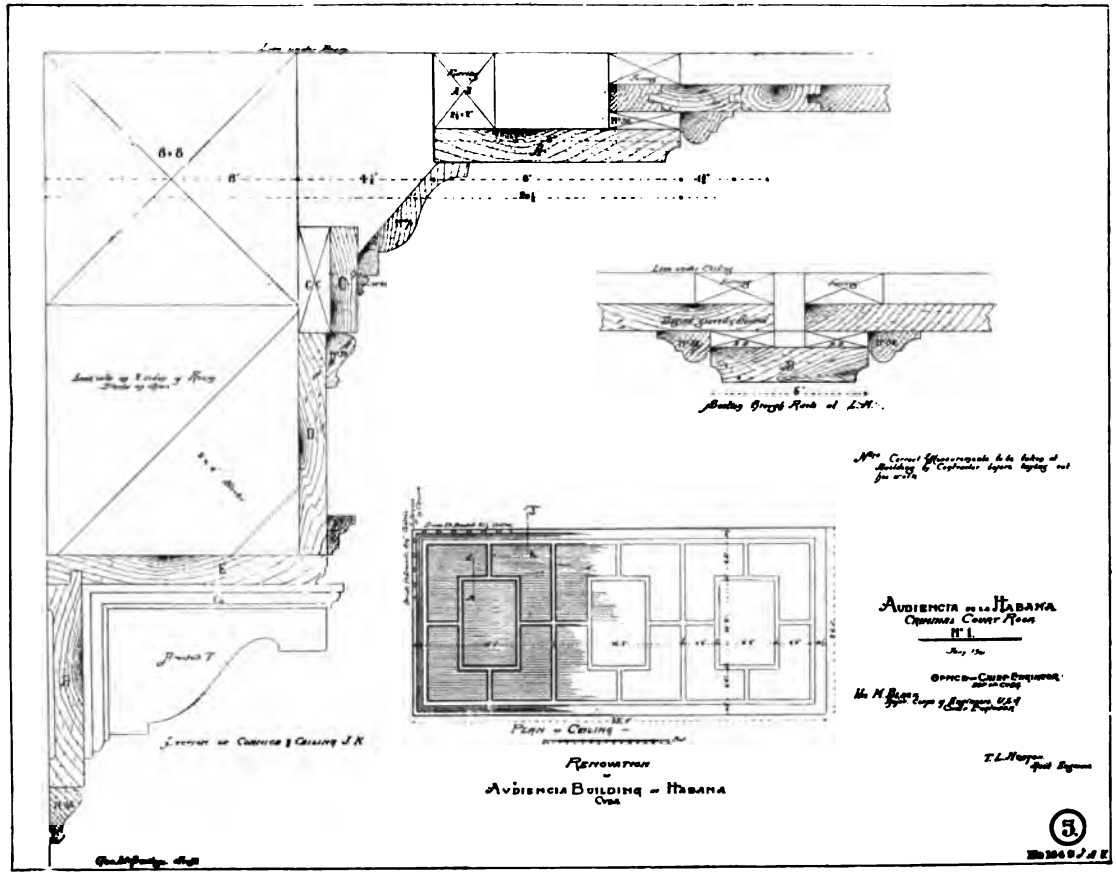
Digitized by Google

HABANA CARCEL. AUTOMATIC TROUGH URINAL.

HABANA CARCEL. TYPICAL PRISON CLOSETS.

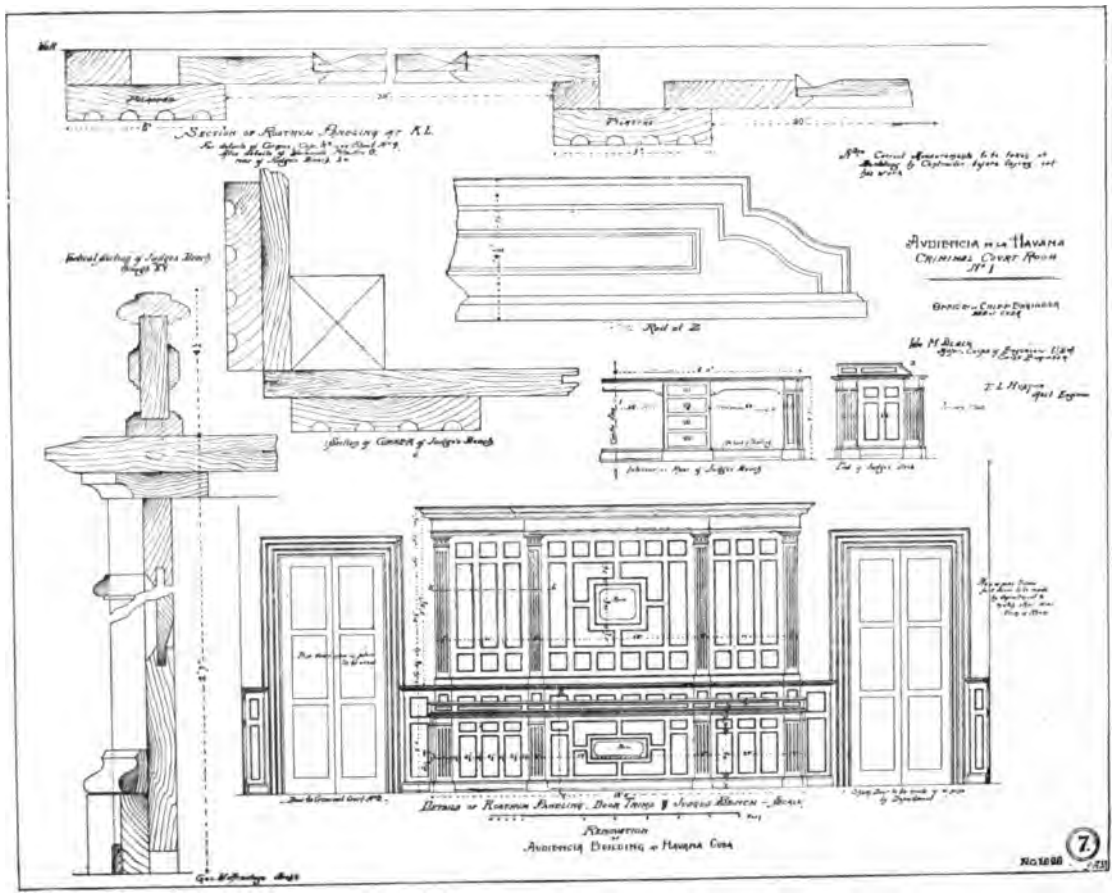
Digitized by Google

Digitized by Google



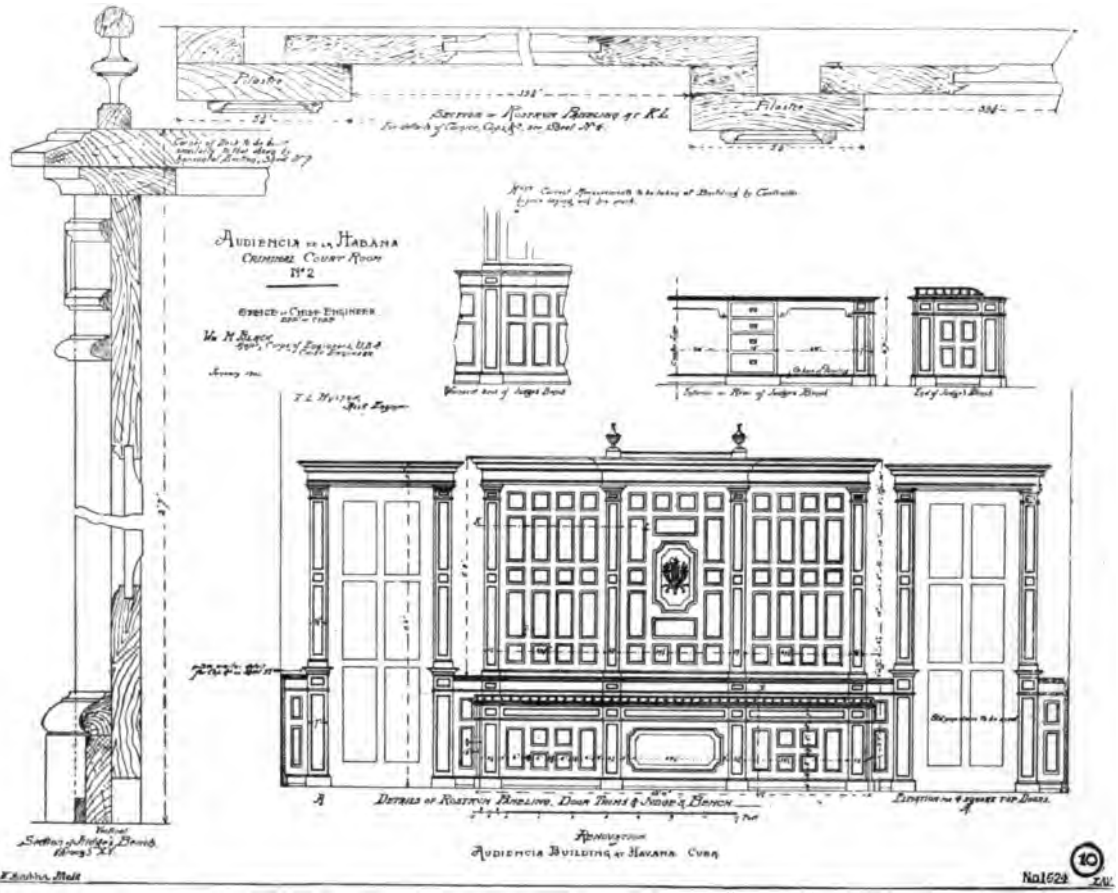
Digitized by Google

Digitized by Google

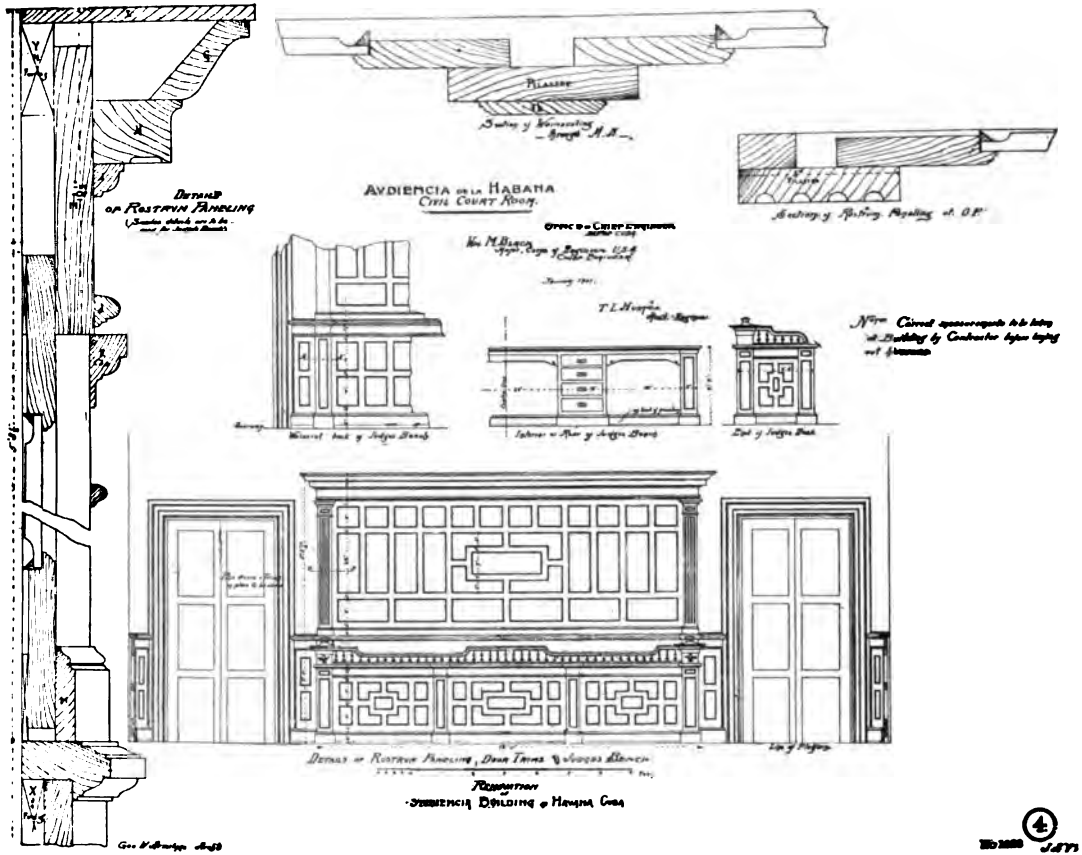


Digitized by Google

Digitized by Google

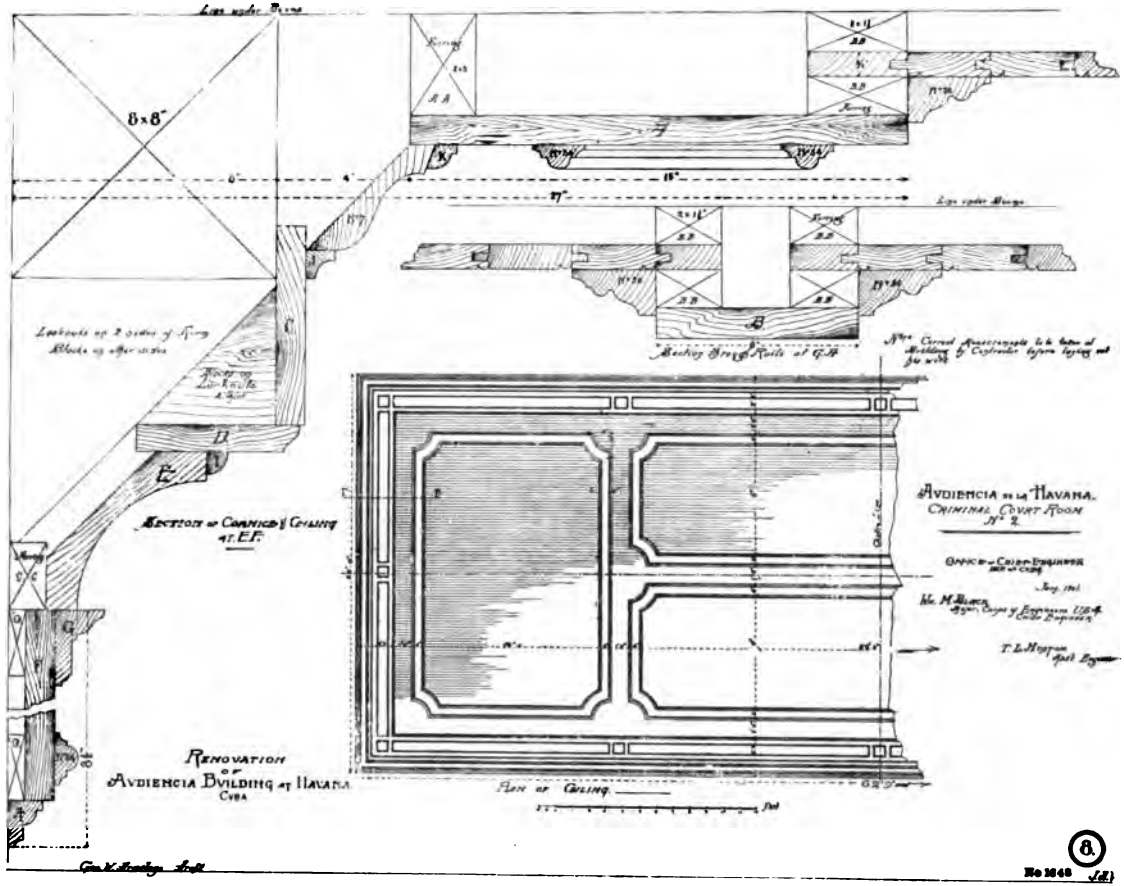

Audiencia de la Habana
Criminal Court Room
Nº 2
Office of Chief Engineer
Wm M. Black
Pilaster
Pilaster
Section of Railing at R.L.
Section of Railing at Bar
Section of Railing at Judge's Bench
Section of Railing at Judge's Bench
Section of Railing at Judge's Bench

Digitized by Google



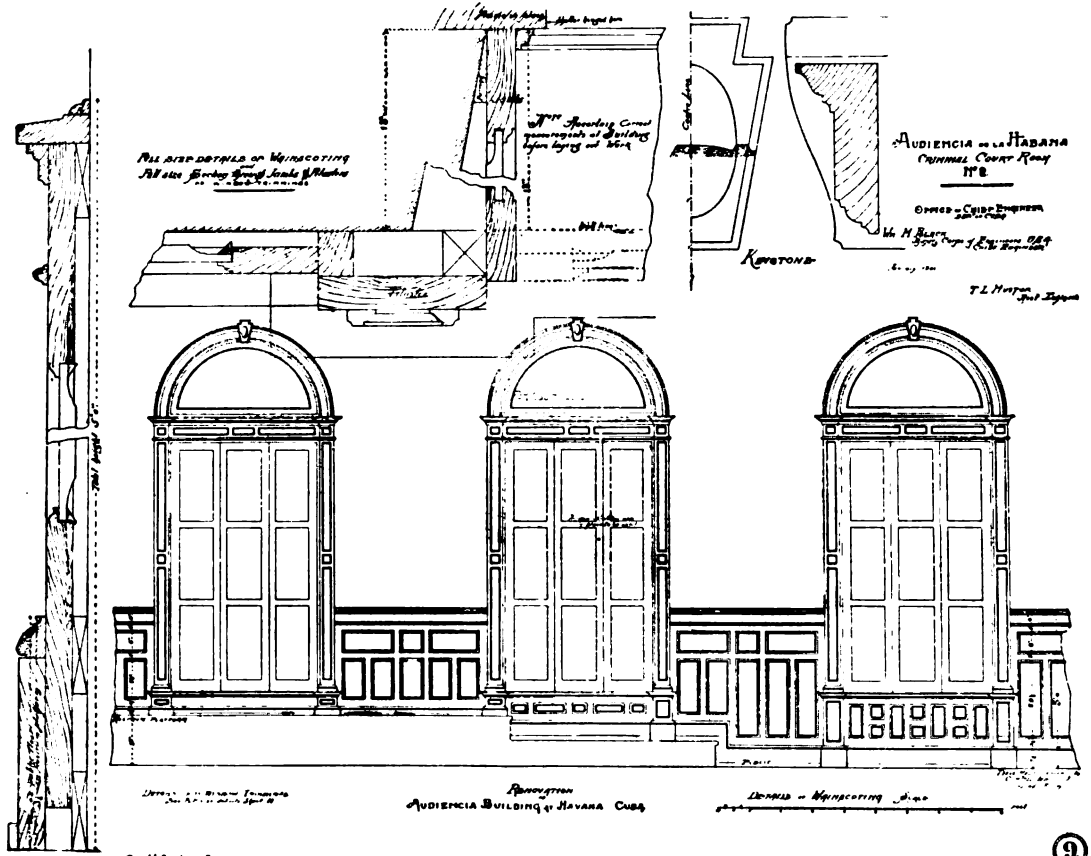
Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google



Digitized by Google

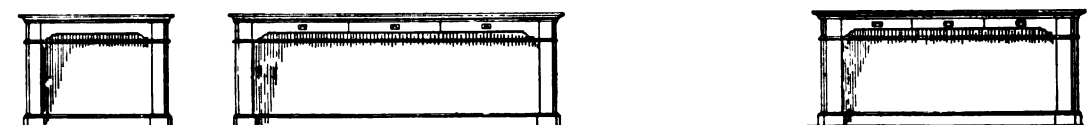
Digitized by Google

Fiscal Bench (1 like this)
Lawyers Bench (2 like this)
Ends of Lawyers & Fiscal Benches
Table for Secretaries (1 like this)
Ends of Secretaries Table

FURNITURE FOR CIVIL COURT ROOM

Fiscal Bench (1 like this)
Lawyers Bench (2 like this)
Ends of Lawyers & Fiscal Benches
Table for Secretaries (1 like this)
Ends of Secretaries Table

FURNITURE FOR CRIMINAL COURT ROOM Nº 1



Typical Interior or Rear part of Court Benches. Tables

NOTE. For full size details, follow similar details given sheets Nº 4 & 10 for the Rostrum of each Court Room. Sizes given here are sizes of Tops

Fiscal Bench (1 like this)
Lawyers Benches (2 like this)
Ends of Lawyers & Fiscal Benches
Table for Secretaries (1 like this)
Ends of Secretaries Table

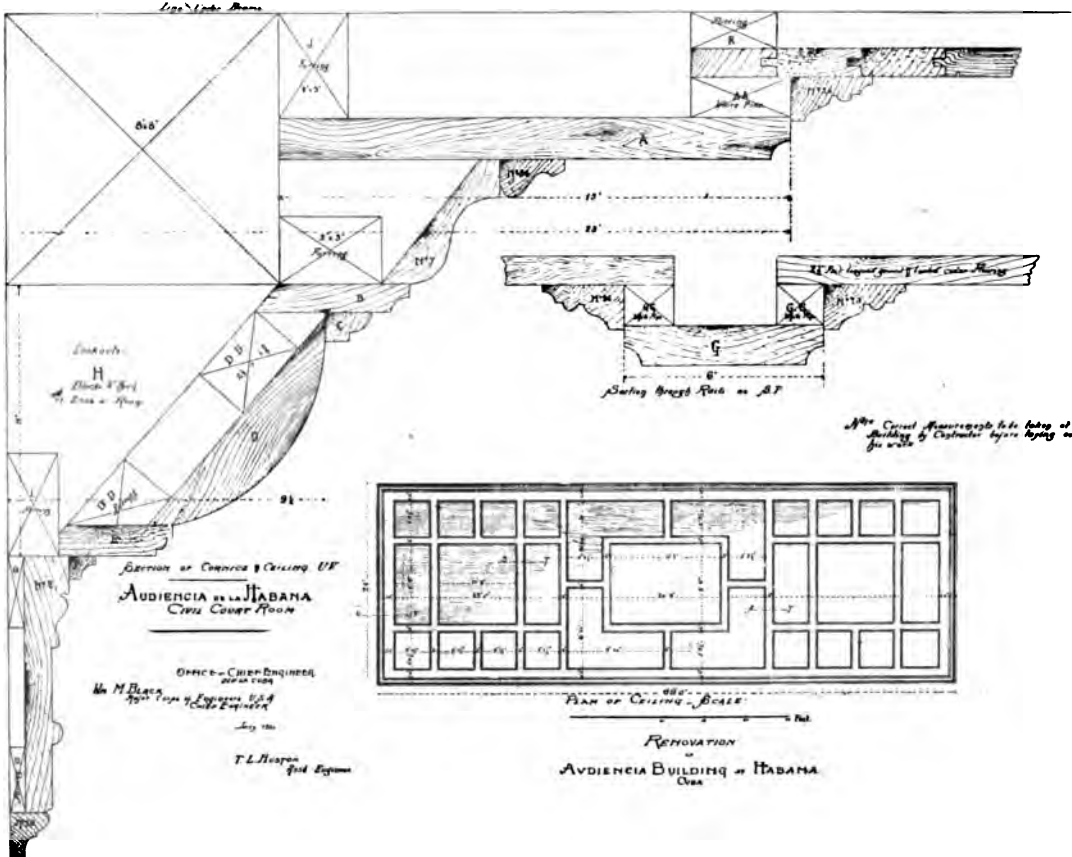
FURNITURE FOR CRIMINAL COURT ROOM Nº 2.

RENOVATION OF AUDIENCIA BUILDING, AT HAVANA CUBA

No 1625

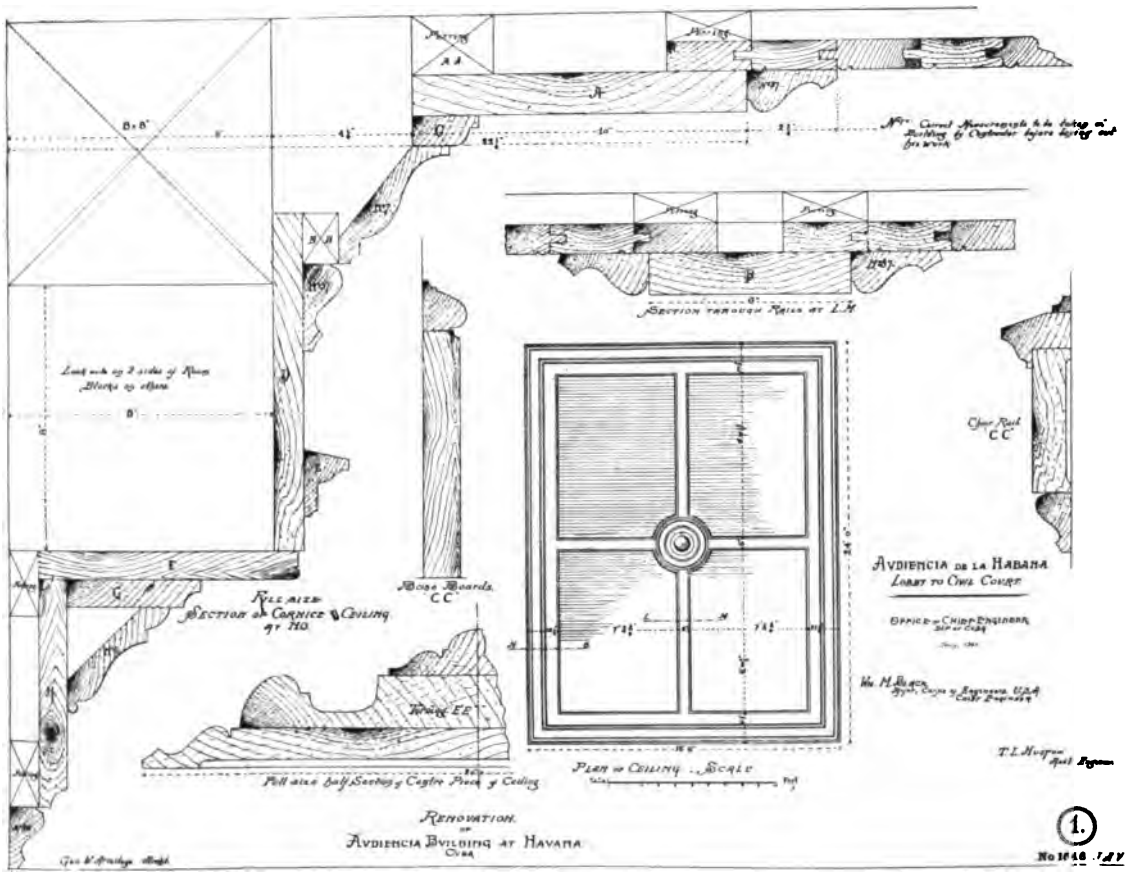
14

Digitized by Google



Digitized by Google

Digitized by Google


Section through Rails at L.H
Chair Rail C C
Base Boards C C
Section of Cornice & Ceiling
Full size
Plan of Ceiling
Scale
Full size half Section of Cofin Panel & Ceiling
Avdiencia de la Habana
Lobby to Civil Court
Office of Chief Engineer
Renovation
of
Avdiencia Building at Havana
Cuba
1.

Digitized by Google

WORK PERFORMED BY GOVERNMENT FORCES.

A roof was constructed over east rear patio to shelter new steam laundry apparatus. Heavy framing, high enough to provide ventilation, was placed on wall separating carcel from the presidio to receive rafters. The other ends rested in the wall over audiencia balcony on second floor, where there was located, on new roof, a ventilator and skylight. The roof covering was of galvanized iron.

Guttering and down spouts were provided. Similar roofs were also placed over the two sets of showers on opposite side of rear patio. Where the roof comes in contact with top of prison windows, a space was left for light.

Trolley track was constructed for the passage of food conveyors from kitchen to front end of main patio. The room utilized for steam kitchen being dark and poorly ventilated, 6 window openings were cut into wall, located to correspond in every respect to existing openings on that side of the main carcel structure, and the gratings were made unnecessarily heavy to harmonize with existing antiquated ones. Heavy wire mesh was placed in the openings to prevent passage of weapons from the street. The excavation in the rock walls, the shoring up of floor beams above and the lining of jambs with masonry and plaster, was a tedious and an expensive operation. Coal box and screen to showers were placed in rear patio.

In the audiencia, on the second floor of the building, slat partitions were placed at main toilet rooms, 2 partitions were removed on north row of offices to afford larger rooms, and, to light same, there were placed on roof 4 flat skylights of heavy opaque glass, placed slightly above roof level. Sliding curtains were fitted below glass as a shield against the glaring rays of the sun. Floors of corridors were repaired. Roof leaks were stopped by somewhat extensive repairs, but any permanent stoppage of leaks to the old tile roofs of the Habana buildings appears to be an impossibility. A new wood ceiling was placed in judges' extreme north toilet room. A balcony leading from the end of corridor which branches from main corridors to the north court rooms, to the north toilet room referred to, was constructed over laundry of carcel below.

This balcony is supported by cantilever I-beams supported firmly by the walls of the building, upon which is placed a floor of heavy 3-inch mesh expanded metal, concrete 4 inches thick, and a top coat of Portland cement mortar one-half inch thick. One side of the balcony is the wall of the court room and the other side is of ornamental railing topped with pivoted windows and Louvre blinds terminating on laundry roof. After contractor had completed concrete floors as originally authorized, government forces paved corridors around main corridor with concrete.

The result of the expenditure upon this structure is the conversion of a filthy relic into a prison with as perfect sanitary appointments as the conditions will admit of, requiring only the intelligent direction of the stored-up energy of the prisoners to maintain that cleanliness which will preserve perfect health among the inmates. The new work is on a par with the latest institutional practices in the United States, and will bear any reasonable criticism.

The sanitary arrangements for the audiencia are perfect.

Items of cost:

Slat partitions (much of the material on hand)	square foot..	$0.07
Wood work for trolleys	linear foot..	.12
Placing 4 skylights 2½ by 7½, including cutting openings, mason work, shades, at each $77.27, or per square foot complete		4.18

ESTIMATE NO. 4 OF THE CARCEL AND AUDIENCIA IMPROVEMENTS.

In September, 1900, upon verbal order of the military governor, an estimate was prepared for the renovation and ornamentation of the offices and court rooms of the audiencia de la Habana. A careful examination of the building demonstrated that the stairs, halls, and court rooms, at one time sufficiently well decorated, were showing signs of decay; iron work, wall paper, and hangings falling off, etc. The necessity was also felt for more modern arrangements for the court rooms, facilities for filing records, and decorations suitable to the uses of the rooms and to the dignity of the surroundings. A project and estimate covering all requirements was prepared by this department and forwarded on November 9, 1900, with request for an appropriation of $16,500 for this work. Authority to proceed was given November 13, 1900. Drawings were immediately prepared and work begun, slowly in advance of complete plans. This work will include when finished the washing and cleaning up of all painted parts, the scraping of walls, the repairing of all deficiencies in plastering, the painting, calcimining, and decorating of walls and woodwork in hall (first and second floors), stairway, and dome, secretary's room (south side), record room, lobbies for civil and criminal courts, and three court rooms; to laying of new marble tile flooring

Digitized by Google

in entrance hall (first floor) over old stairway in fiscal's office, and in new toilet room at end of balcony; new grille work in entrance hall and record room; four new newel posts and the repairing of iron stair railings and hand rails; the tearing out of old partitions and entresuelo in president's rooms and of stairway in fiscal's office; the erection of new partitions in same rooms and in toilet room at end of balcony; the cutting of doorways and erection of new doors to president's room, to fiscal's room, and to record room; the arrangement of three toilet rooms with complete plumbing in president's room between criminal court rooms and at end of new balcony, and a general repairing of woodwork, doors, windows and blinds, skylights, framing and flooring, etc. Three double door safes are also to be furnished. The principal part of the work to be done, however, is the interior woodwork and decoration of the three court rooms and lobby room to civil court.

Plans for this work has been carefully studied and are now completed. The wood to be used will be selected Spanish cedar. The ceilings of the lobby will be decorated with handsome panelings, moldings, and cornices, and on the walls will be placed picture moldings, chair rail, and base board.

The three court rooms will receive a loftier treatment; paneled wainscoting five feet high on main floor will decorate the walls. This paneling, surmounted by a handsome cornice over side pilasters, will extend to a height of 10 feet 6 inches from main floor on rostrum at the back of judge's bench. These benches will replace the old-fashioned tables now in use. They will be handsomely paneled on front facing the court and on sides. The interior will be fitted with drawers, etc., for the use of the judges and assistants.

Tables, desks, etc., of a modern type will be provided to replace the old furniture.

The treatment of each court room, although similar in general arrangement, will, however, be different in design and of a pleasing variety, suited to the decoration of a court room.

Criminal court room No. 2, which at present has no door, window trim, or jambs, will be ornamented with same. The wall decorations for the whole is now being studied so as to produce a quiet, tasteful, and dignified effect.

Estimate:

Entrance—		
Removing and relaying old tile floor	$83.00	
Laying new marble tile, 620 squares, at $1	620.00	
Cleaning and painting gratings and iron rails, cleaning and repairing newel posts, statues, etc	140.00	
Painting woodwork, doors, windows, ceilings, and beams, 75 squares, at $3	225.00	
65 squares kalsomining walls	39.00	
300 square feet grille work to take the place of present unsightly partition, 300 square feet, at $1.25	375.00	
		$1,482.00
Stairway and dome—		
Preparing walls, 36 squares, at $2	72.00	
Painting and decorating side walls, 36 squares, at $4	144.00	
Decorating dome, 6 squares, at $10	60.00	
Scaffolding	40.00	
		316.00
Hallway at head of main stairway—		
Preparing, painting, and decorating walls, 40 squares, at $7	280.00	
Taking down dilapidated partition at entrance president's room	20.00	
5 squares expanded metal partition, at $30	150.00	
72 square feet glass doors and transoms, at $0.75	54.00	
		504.00
President's proposed toilet rooms, (located between his office and east corridor)—		
Tearing out entresuelo partitions and closing up doors	30.00	
New partitions, 3 squares, at $30	90.00	
Plumbing, to include 1 water-closet, 1 urinal, and 1 basin	190.00	
Enamel painting, 12 squares, at $4	48.00	
		358.00
Taking out stairway which was formerly entrance to warden's quarters, and flooring over wall of same—		
Framing, flooring, alteration to rail and to slop sink in corridor, cutting new door to corridor, etc	120.00	
115 squares marble tile floor, at $1	115.00	
		235.00
Lobby for civil court room—		
42 squares removing wall paper and repairing walls, at $1	42.00	
34 squares sizing and painting, 2 coats, at $3	102.00	
704 square feet Spanish cedar ceiling, at $0.50	352.00	
Oiling and varnishing new woodwork, 6 squares, at $3	18.00	
Decorating and retouching	40.00	
Repairs to blinds	5.00	
		559.00
Civil court room, similarly treated		2,007.00
Criminal court room No. 1, similarly treated		1,341.00
Criminal court room No. 2, similarly treated		1,669.00
Renovating lobby room at west end of criminal court, similarly treated, omitting new ceiling and wainscoting		496.50

Digitized by Google

Estimate—Continued.		
Proposed toilet room between court rooms—		
245 square feet tile floor, at $1	$245.00	
2 squares plastering, at $30	60.00	
Painting	80.00	
Partitions	20.00	
Plumbing, to include 1 water closet, 1 urinal, 1 marble basin, etc	167.00	
		$572.00
Proposed toilet room at end of new balcony—		
224 square feet tile floor, at $1	224.00	
Partition	25.00	
Painting	52.00	
Plumbing, to include water-closet, urinal, and basin	162.00	
		463.00
Secretary's room, south side—		
Removing old paper and repairing walls	50.00	
34 squares sizing, painting, and decorating, at $5	170.00	
Painting doors and windows	52.00	
Repairs to woodwork	15.00	
		287.00
Record room—		
Cases as per sample requested, 150 linear feet, at $6.50	975.00	
50 cubic feet brick in partition, at $0.70	35.00	
Plastering	45.00	
New grilles	40.00	
Opening doorway, casing and door; repairing skylight, cleaning, painting and kalsomining	55.00	
		1,150.00
Furniture requested—		
13 double flat-top desks, at $60	780.00	
2 oak tables 8 feet long	130.00	
1 hardwood panel canopy over judges' bench	268.00	
3 mahogany tables for judges	183.00	
15 mahogany tables for lawyers and clerks in court room	1,110.00	
		2,471.00
Safes requested, 3 double-door safes 5 by 3 by 2½, approximately		990.00
		14,900.50
10 per cent for incidentals		1,490.00
		16,390.50

For this estimate the department was allowed $16,500 as above stated.

ESTIMATE NO. 3.

In compliance with verbal orders from the military governor, an estimate amounting to $2,570 was prepared for renovating and remodeling the main office at the Habana cárcel.

This estimate was forwarded with recommendations that if approved authority be granted to execute the work with hired labor. On November 14, 1900, this estimate with accompanying recommendations was approved by the division commander. Plans were immediately prepared and work of remodeling, which is now well under way, was commenced.

Several old partitions and an entresuelo were removed, leaving a large airy room 25 by 38 feet and 24 feet in height. Heavy Spanish cedar beams span the width of the room at the ceiling. These will be dressed down and finished in the natural wood. The side walls will be patched and treated with a neat but plain decorative finish. New mosaic tile floor will be laid and all the woodwork now existing in the four window openings will be replaced with new Spanish cedar window casing and sash. Provision will be made to secure light and ventilation together during all conditions of the weather.

In one corner of the room a private office, size 11 by 11 feet, for the use of the chief in charge of the cárcel, will be inclosed by paneled and carved Spanish cedar screen 8 feet in height. In the upper panels of the screen muranese glass of appropriate design will be set. Along one side and part of one end of the room record cases 12 inches in depth will be erected, extending from the floor to the ceiling. The lower portion of the cases for a height of 3 feet 4 inches will be projected and finished with a narrow shelf. The face of the projected portion will be divided into panel doors separated by base of pilasters. Above, the case will be divided into two tiers containing shelves for records, which will be inclosed by sliding doors with clear glass. The top of the lower part will be about 14 feet from the floor and will be made accessible by a neatly finished hard-wood ladder which will be provided with hooks at the upper end that will hang over and be supported by a brass rail, which in turn will be supported by neatly designed brass brackets. This rail will be extended entirely across the front of the cases at a height of 8 feet 6 inches from the floor. Extending along the entire front of the cases, at a height of 14 feet 8 inches from the floor, a gallery 21 inches wide is to be built and supported by heavy brackets of Spanish cedar. Along the outer edge of this gallery an ornamental railing of wrought iron will be placed and finished with a neatly molded handrail. This gallery will

Digitized by Google

be made accessible by a light steel stair ladder with hard-wood treads and brass handrail, to be placed at one end of the gallery. All records in the upper tier will be easily accessible from the balcony.

All exposed woodwork in the office will be finished in hard oil, and throughout the office at points requiring them electric lights will be installed.

Estimate:

Removing entresuelo floor	$30.00
Removing partitions	30.00
Hauling	25.00
1,000 square feet of record cases, at $1	1,000.00
Varnishing 30 squares ceiling, at $3	90.00
Kalsomining 40 squares walls, at $1	40.00
Painting 6 squares woodwork, at $3	18.00
Gallery	150.00
Plastering	25.00
240 square feet partition inclosing office, $0.60	144.00
10 squares mosaic tile, at $24	240.00
200 square feet frosted glass windows, at $0.50	100.00
200 square feet slat blinds, at $0.50	100.00
Electric lighting: Two 4-light chandeliers, fifteen 1 and 2 light brackets, 23 lights, at $15	345.00
	2,337.00
10 per cent for incidentals	233.70
	2,570.70

Estimate has been approved for lighting the patios and the streets around the cárcel building for protection and as a means of economy in guards, and also for gas lighting throughout all the cells, the old system being in very defective shape.

This work will be proceeded with as rapidly as feasible.

ESTIMATE NO. 5.

Arc system:		
10 arc lamps, at $35	$350.00	
1 4,000 watt transformer, at $0.05 per watt	200.00	
8 arc brackets, at $15	120.00	
2 arc poles, etc., at $15	30.00	
1 switch board	15.00	
Insulators, brackets, tubes, etc	35.00	
1,200 feet No. 6 weather-proof wire, 146 pounds, at $0.37½	54.75	
800 feet No. 6 weather-proof wire, 60 pounds, at $0.37½	22.50	
Labor	50.00	
		$877.25
Gas system:		
Black iron gas pipe—		
250 feet 2 inch	50.00	
300 feet 1¼ inch	45.00	
200 feet 1½ inch	24.00	
1,750 feet ¾ inch	70.00	
400 feet ½ inch	12.00	
150 S burner cocks	52.50	
Fittings	40.00	
1 2-inch valve gate	4.50	
Labor	300.00	
		598.00
Total		1,475.25
20% for contingencies		295.05
Total		1,770.30

ESTIMATE NO. 2.

On September 4, 1900, a communication was received from the chief of the carcel to have additional concrete floors constructed.

In the first indorsement, civil file D. of C., No. 5007, O. C. E. file D. of C., No. 125, the chief engineer of the division recommends that at present the concrete work be constructed around the patios. This was not estimated for at first, as the old pavements were considered fairly good. The new work makes such a contrast and abuts so badly on the old pavement that 774 yards of additional pavement at an estimated cost of $1.55 per square yard, or a total of $1,200, was approved. On September 27, 1900, a request was made to have the work done by hired forces, as it was impossible to contract the work at the prices named, $1.55 per square yard. This was approved October 2, 1900, and the work constructed as above outlined.

Financial statement:

Total approved estimate or cost of work		$56,943.70
Total allotments received		51,754.90
Total expenditures	$38,651.74	
Returned to treasury	5,136.90	
		43,788.64
Balance unexpended		7,966.96
Outstanding liabilities		2,305.03
Balance available December 31, 1900		5,661.93

Digitized by Google

QUINTA DE LOS MOLINOS.

Estimate No. 1, for the improvement of the fence inclosing the grounds, $877; project approved in civil file D. of C., No. 1236, June 9, 1900; O. C. E. D. of C., No. 204.

The fence at Quinta de los Molinos was found in a much neglected condition. The pillars are constructed of Cuban limestone, and faced with a coating of mortar.

On June 19, 1900, work was started, removing all defective and loose parts. Cement and lime mortar was used to replace all parts removed and to repair the previous damage.

On completion of masonry repairs, the iron work of fence was thoroughly scraped and sandpapered, this being necessary on account of numerous applications of "whitewash."

The columns and base were painted two coats alabastine, a cold water preparation of kalsomine. The iron pickets were painted two coats chapapote, a coal tar. The spearheads were painted in imitation of bronze. The gates, excepting main entrance gate, were painted two coats chapapote. The grenades surmounting columns were painted two coats chapapote, and two new ones were placed.

Items of cost:

Mason work, at $0.64 per square yard	$250.33
Alabastine columns and base, at $0.09 per square yard	298.18
Painting iron work, at $0.07 per square yard	130.09
Spearheads, at $0.26 each	26.00
Repairing gates	21.50
Re-kalsomining entire surface, at $0.02 per square yard	70.18
Drayage, etc	68.70
Total	864.98

FUERZA ELECTRIC PLANT.

Estimate No. 1, for installing an electric-light plant in the ditch at the Cuartel de La Fuerza, $33,846. Project approved in civil file D. of C., No. 4203; O. C. E. file C. of H., No. 7327-3.

Estimate No. 2, for changing location of stack and putting in a smoke-consuming apparatus, $5,725. Project approved in civil file D. of C., No. 1236, December 20, 1900; O. C. E. file D. of C., No. 239-29.

In the boiler room a new concrete floor has been constructed. The I beams and the cast-iron columns for boiler shed are on the ground. This work has been necessarily delayed; first, on account of the tardy delivery of the material ordered from the States, and later, by the contemplated change as indicated in estimate No. 2. The delays, however, have not interfered with the operation of the plant, the boiler having been protected by heavy tarpaulins.

The complete plant was tested and accepted by the department October 8, 1900, and turned over to the chief quartermaster of the division, October 17, 1900.

Estimate No. 2 is for the erection of a stack directly alongside the tower of the building of the captain of the port; the top of the stack to project 5 feet above the top of the tower, and the entire stack to be inclosed in a square boxing of expanded metal and plastering, which will harmonize with the rest of the building and be scarcely noticeable.

The stack will be carried across from the present position of the boilers to new location, through a room in the Fuerza, which is now but little used, and through the top of a room used as a stable by the captain of the port. It will be so placed as to interfere but very little with the other uses of the room and stable.

A fan will be inserted in the stack close to the boilers, so as to provide an induced draft. Should it prove necessary, in addition to this, mechanical stokers can be placed on the front of the boilers, which will make an economy in the use of coal, and will still further tend to consume the smoke, inasmuch as the coal is fed from the front, and any smoke formed passes over a bed of live coals and is consumed before it enters the stack.

Estimate:

Taking down stack	$275.00
Changing smoke connection	90.00
Fan connection, 450 pounds steel, at $0.09	40.50
3 mechanical stokers for 100-horsepower boiler	3,000.00
1 90-inch exhaust fan	525.00
Foundation including extension for stack	325.00
Placing section of new stack	50.00
3,200 pounds angle-iron frames and braces, at $0.10	320.00
Plastering 9½ squares, at $15	142.50
	4,768.00
20 per cent for contingencies	953.00
Total	5,721.60

Digitized by Google

The total capacity of the La Fuerza electric plant is 1,750 lights, allowing 10 per cent for drop.

As usually only two-thirds of the lights in any building are in use at the same time, the capacity of the plant can be safely figured at 2,000.

The two palaces at present supplied by this electric-light plant contain 1,300 lights, leaving a surplus of 700.

This surplus may be utilized as follows:

	Approximate cost.
Maestranza, 200 lights	$4,350.00
Tacon No. 1, 175 lights	750.00
Engineer's department, 150 lights	2,000.00
Captain port building, 175 lights	146.50
	7,246.50
10 per cent for contingencies	724.65
Total	7,971.15

NOTE.—Tacon No. 1 and captain of the port's building are already wired. In order to utilize the full boiler capacity of existing plant and to thereby save the government money and electric bills, it is proposed to install a 50 kilowatt alternating current generator and appurtenances at the following cost to perform the services indicated:

1 50-kilowatt alternating generator	$2,600.00
1 75-horsepower compound engine	2,000.00
Foundations	300.00
Lighting custom-house wharf	1,750.00
Lighting post-office	250.00
Lighting captain of the port's building	146.50
Lighting Tacon No. 1	750.00
Lighting Maestranza	2,950.00
Lighting engineer's office, Tacon No. 3	2,000.00
Lighting passenger landing	1,250.00
Total	13,996.50
Contingencies	1,750.00
Total	15,746.50
Approximate cost of lighting the above buildings by purchasing current per year	30,000.00
Approximate cost of lighting from La Fuerza plant, per month, $1,600; per year	$19,200.00
6 per cent interest on investment	944.79
10 per cent repairs, etc	1,574.65
	21,719.44
Balance or saving by means of increase of plant	8,280.56
To summarize:	
It will cost to utilize present surplus electric power at direct current	7,971.15
Same including relocating stack, induced draft, etc	14,550.90
It will cost to utilize surplus electric power and surplus boiler power using alternating current	15,746.50
Same with relocation of stack, induced draft, etc	22,326.25

D. W. Shea was in charge of work.

PASSENGER LANDING BUILDING.

Estimate No. 1, for the construction upon a pile foundation already in place, a building to be used as a passenger landing, $42,000. Project approved in civil file D. of C., No. 2989, September 8, 1900; O. C. E. file D. of C., No. 254.

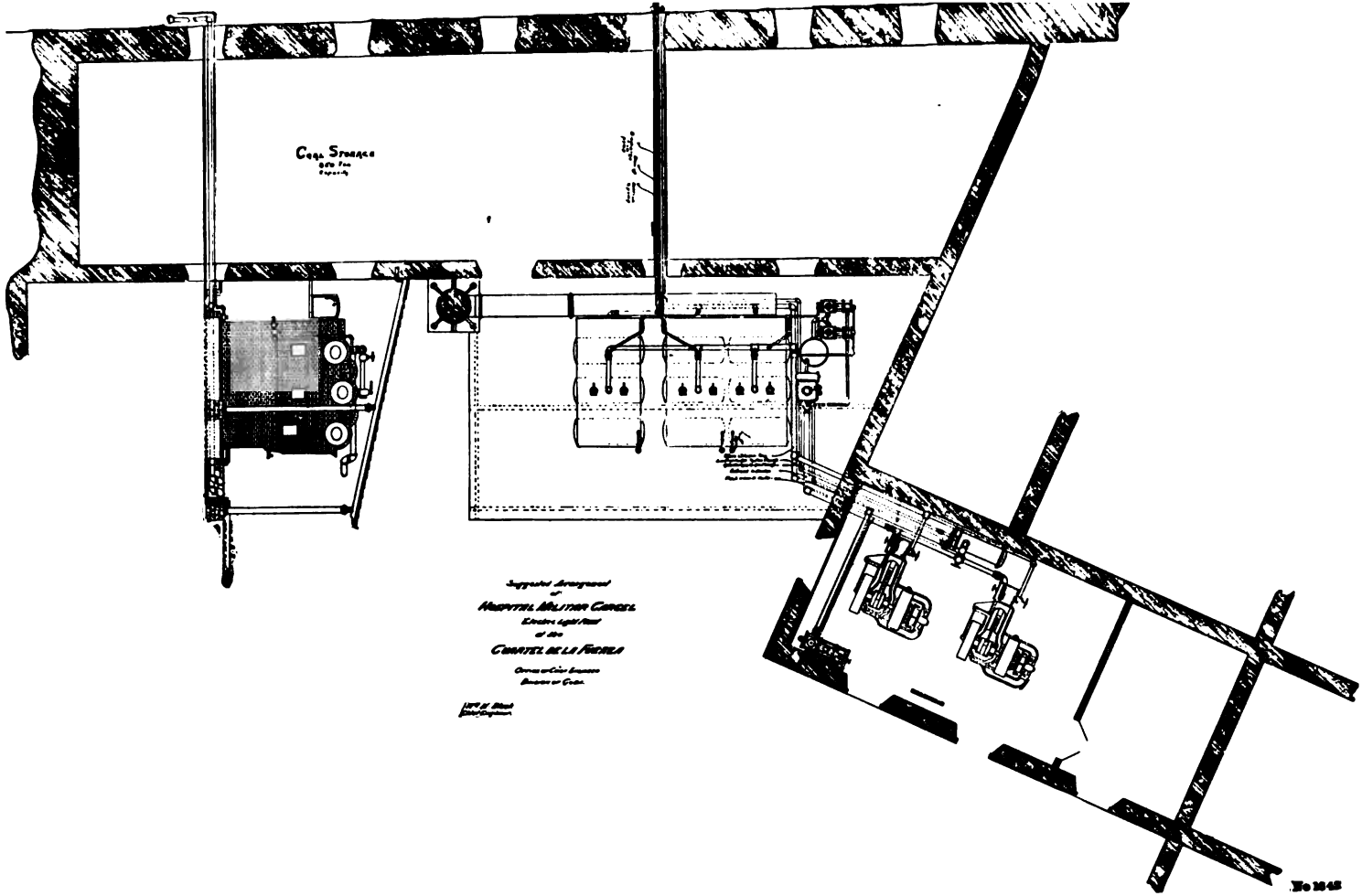
Request for authority to test piles in existing foundation showing signs of weakness. Work to be done by contractors at actual cost, plus 15 per cent. Project approved in civil file D. of C., No. 1236, October 19, 1900; O. C. E. file D. of C., No. 254–22.

Request for authority to drive anchorage piles. Work to be done by contractors at actual cost, plus 15 per cent. Project approved in civil file D. of C., No. 2989, November 23, 1900; O. C. E. file D. of C., No. 254–30.

On July 5, 1900, estimates of costs for the erection of the proposed passenger landing, amounting to $51,286.44, and a set of drawings giving a general idea of the project were forwarded to the military governor. The estimate stated several items on which saving could be made, and was accompanied by a request, stating that on account of the great importance of the rapid completion of the building authority be granted to execute the work by hired labor, purchasing the materials in open market, or by contract, as might be most economical. The plumbing work to be done by contract.

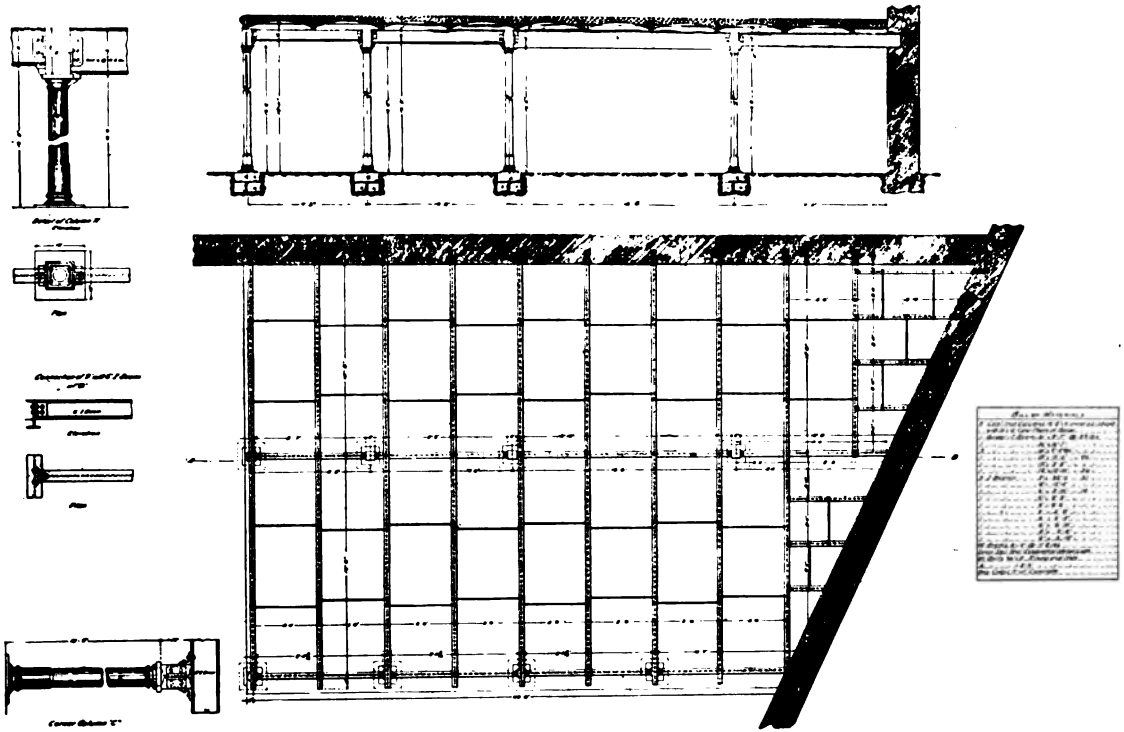
On July 6 this communication was returned with the statement that the work in question could not be undertaken without formal contract, the amount of money involved being too large. Authority was granted to proceed and prepare complete plans and specifications and submit same, which was accordingly done.

Digitized by Google



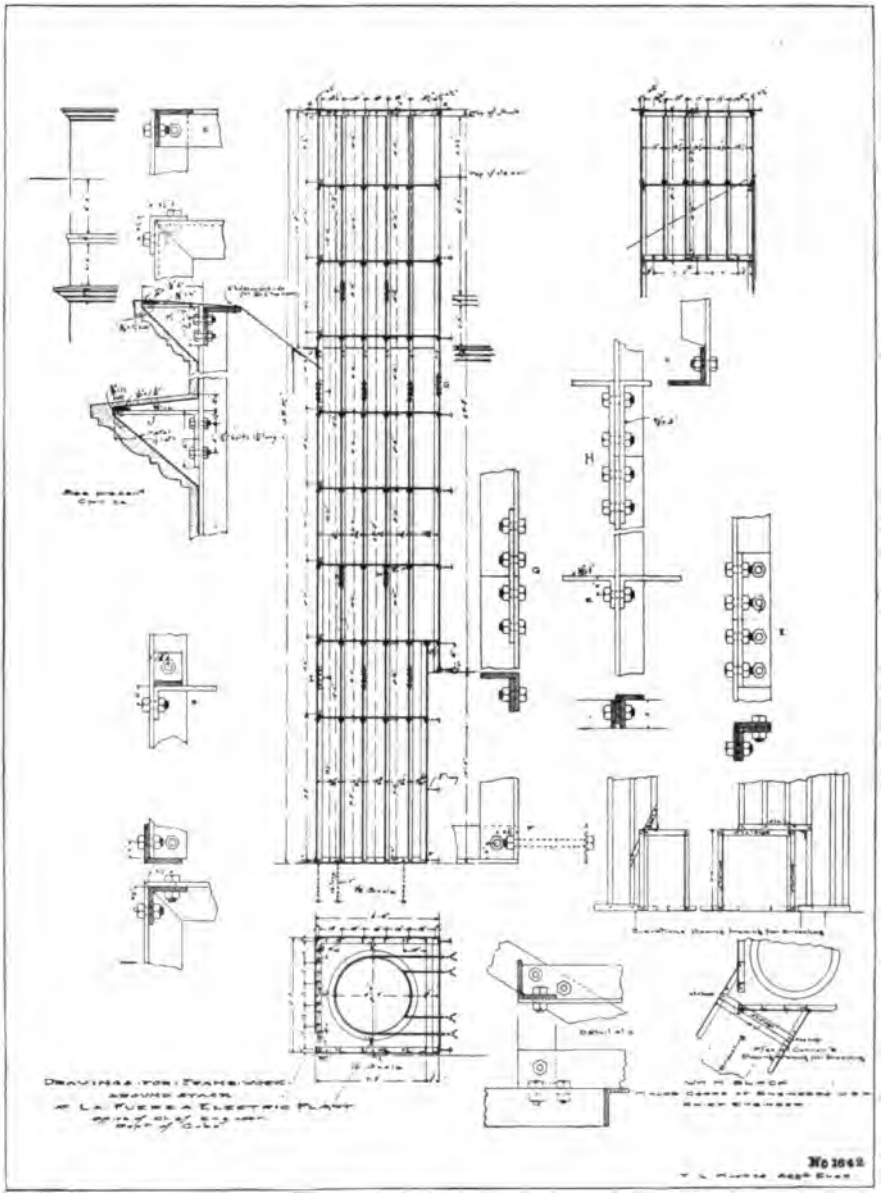
Digitized by Google

Digitized by Google



Plan and Sections of Roof of Boiler House for
LA PORTE ELECTRIC PLANT

Digitized by Google



LA FUERZA ELECTRIC PLANT. FRAMEWORK AROUND STACK.

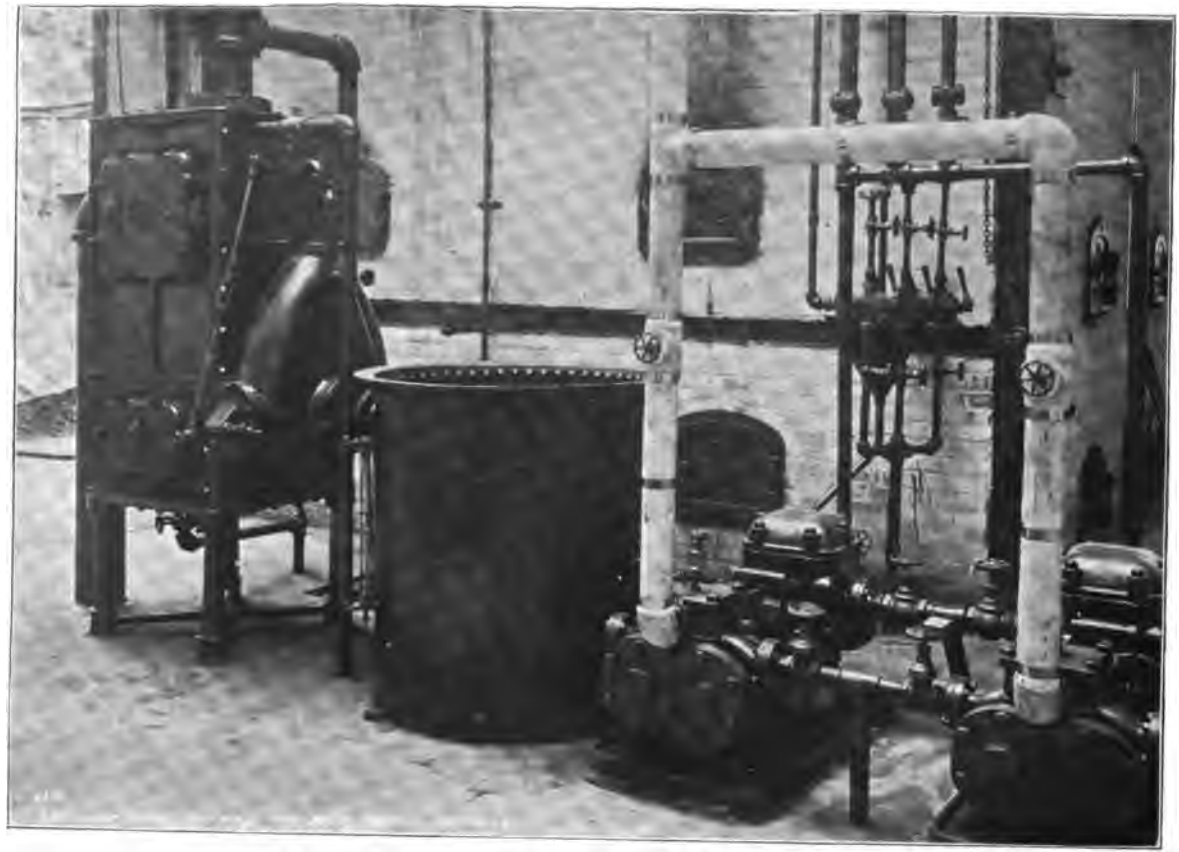
Digitized by Google

Digitized by Google

LA FUERZA. THREE 100-HP. STERLING BOILERS.

Digitized by Google

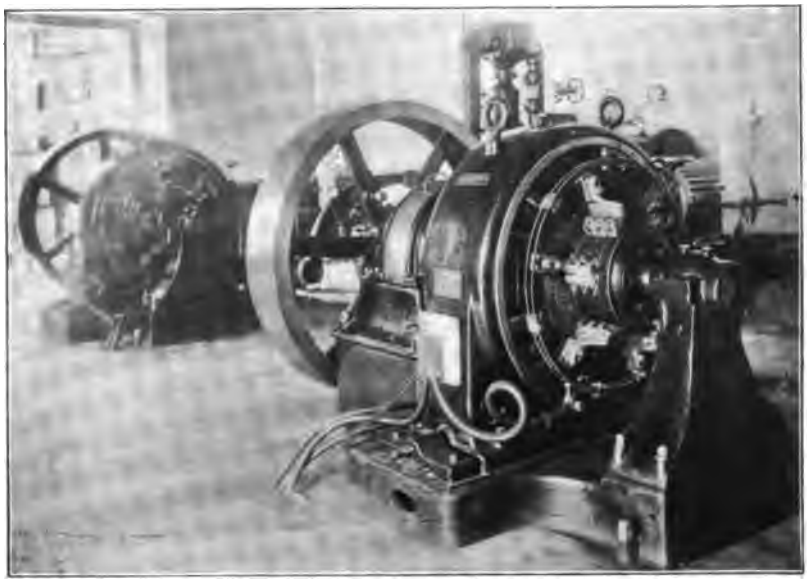
Digitized by Google



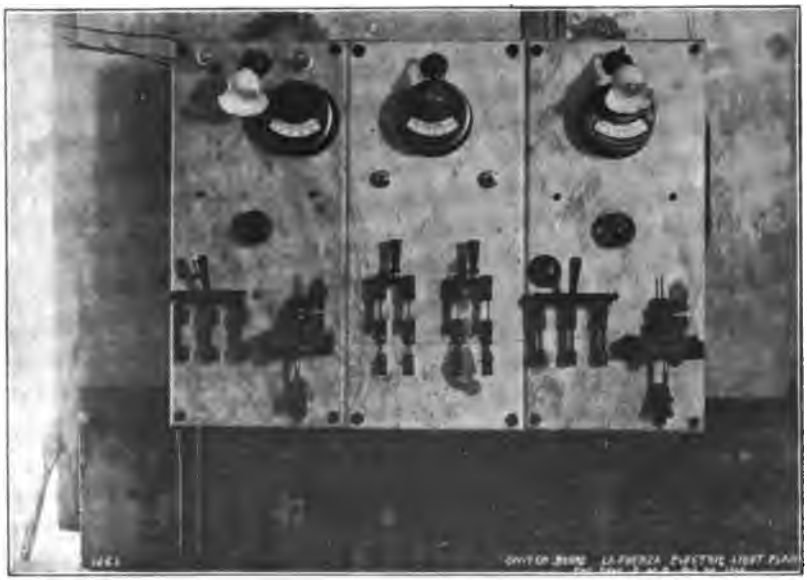
LA FUERZA. FEED-WATER HEATER, HOT WELL, AND BOILER FEEDERS.

Digitized by Google

Digitized by Google



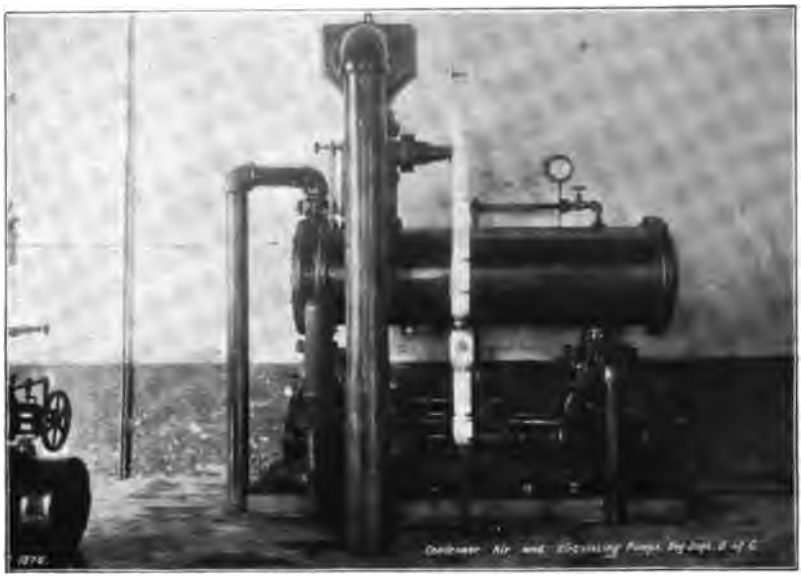
LA FUERZA. TWO 50-KW. DYNAMOS.



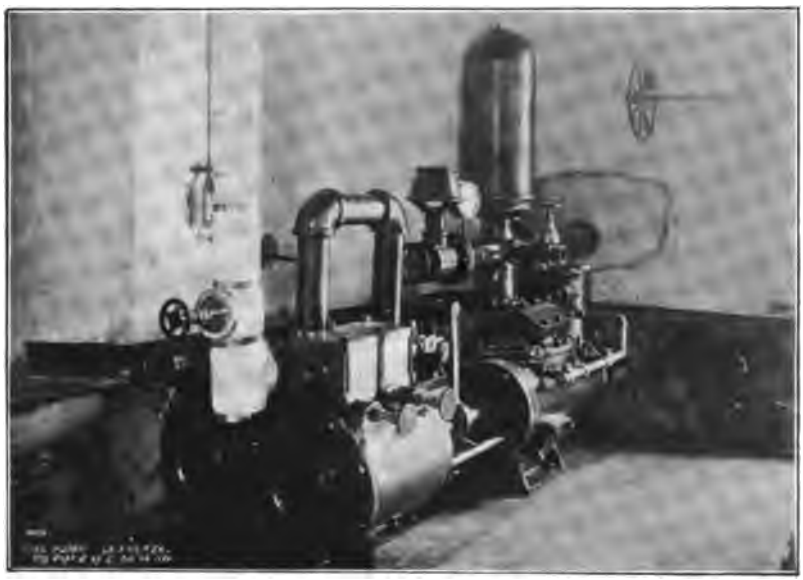
LA FUERZA ELECTRIC-LIGHT PLANT. SWITCHBOARD.

Digitized by Google

Digitized by Google



CONDENSER, AIR AND CIRCULATING PUMPS.



LA FUERZA. FIRE PUMP.

Digitized by Google

Digitized by Google

Bids advertised for on August 17 as follows: Item 1, for furnishing labor and material for construction of building complete. Item 2, for timber in place in foundation, steps and fender per 1,000 feet B. M. Item 3, for piles in place in foundation, per linear foot. Item 4, for iron in place in foundation, per pound.

Bids were received from four tenders as follows:

	No.	Item—			
		No. 1.	No. 2.	No. 3.	No. 4.
Sussdorf Zaldo & Co	1	$42,500.00	$70.00	$1.18	$0.05
Purdy & Henderson	2	51.000.00	100.00	1.15	.09
Parker, Waugh & Co	3	35,500.00	90.00	1.10	.07
Newhall Engineering Co	4	52,500.00	.....	.....	.....

The contract entered into with Parker, Waugh & Co., the lowest bidders, was approved September 28.

The chief engineer estimated that contingencies would make the building cost $42,000.

The contractors in commencing work October 8, removed floor, which disclosed the fact that the foundation upon which this $42,000 structure was to be erected had been built in a very unworkmanlike manner. Piles were found to be driven two and three feet out of position designated on plans, completely clearing the caps they were intended to support and were rendered thereby utterly useless. In other cases, piles that had been driven properly as regards location, had been sawed off too short, affording no bearing whatever for the cap that extended over it. One case in particular served to demonstrate the carelessness of the men in charge of construction of the foundation. A pile having been sawed off above the level of the other piles, prevented the setting of a cap, the cap was dapped out to set over the piles, but too much having been cut out, a shim was driven between the top of the pile and the cap. Upon laying the floor joists it was found that the shim was too thick and that it held the cap at an elevation of 1½ inches above the surrounding caps. To rectify this defect, the contractors dressed off the top of the cap to a level with the other caps, greatly weakening it thereby. The contractors were directed to remove all joists as specified in contract, sills and caps, and to replace the sills and caps with Júcaro timbers, and pull out and replace three piles that had been driven out of place by them under their previous contract. Two fender piles were removed to make room for the pile driver, and the ease with which they were withdrawn caused a doubt as to the stability of the piles forming the foundation of the building. The placing of such an expensive building upon foundations of a doubtful character could not be considered, and ordinary prudence dictated the testing of all piles in the foundation.

No provision having been made in the specifications for this unforeseen work, it having rightfully been presumed that the foundation had been built as contracted for, in which case their strength would have been ample, authority was requested from the division commander to have the work of testing done by the contractors, paying them therefor at actual cost plus 15 per cent for profit. The impossibility of estimating with any degree of accuracy the scope of the work, as it could not have been foreseen to what extent weakness would develop, left this the only rational mode of procedure.

Authority for the above was obtained from the division commander on October 19.

In strengthening the pile foundation, all piles that developed weakness upon being tested were spliced and driven to a solid bearing. Some of the piles required to be spliced three times and in one solitary case a pile was driven 124 feet.

In splicing, the piles were squared and the ends butted, with an even bearing. Júcaro plates 3 by 6 inches by 8 feet were placed on opposite sides of the pile over the joint near corresponding corners, and were clamped by four ¾-inch bolts extending through the pile and plates, with washers under the bolt heads and nuts. In like manner and placed near the remaining corners, four iron plates, size ¾ by 3 inches by 4 feet, were bolted.

The row of piles on the south side were tested first, and only one pile stood the test to which it was subjected. Each of the twelve piles settled from 1 to 6⅝ inches under one blow of a hammer weighing 2,500 pounds, falling from an elevation of 20 feet, notwithstanding the fact, that they had been in place for six months. Each pile was tested separately, and upon completion of the work of strengthening the foundation, each bearing pile or cluster of bearing piles were subjected to a test consisting of loading them to the maximum load to which it was calculated they would

Digitized by Google

be subjected; this latter test being imposed to remove all lingering doubt as to strength of splices. For this purpose a heavy platform, strongly braced and affording sufficient surface to hold the required amount of pig iron necessary to make the weight, was constructed and moved from pile to pile. These tests are now in progress, and the new and strengthened piles have stood the test in every case. The character of bottom into which the piles were driven (it being of mud overlaying a sloping base) created a fear that the whole structure might tip out towards the bay after the erection of the building. To prevent this, a scheme was devised to drive anchor piles on the land side of the building at a distance of 16 feet back from the sills forming support for building on the land side. The foundation caps will be tied to these piles by lengths of railroad iron strapped, bolted, and riveted to the piles and to the ends of the caps. The foundation will also be tied to the old wharf located on the north side of the foundation.

Application for authority to have the contractor do this work at cost, plus 15 per cent to cover profit and rental of their pile drivers, was approved on November 23. Upon arrival of the lumber to be used in the building, which was ordered from the States, the entire shipment was condemned as not conforming with the specifications which called for heartwood throughout and for rift-sawed lumber for the flooring; but few pieces of heartwood could be found in the shipment, and in place of rift-sawed flooring, common pine flooring had been shipped. At present the condition of the work is such that the raising of the ironwork can be commenced shortly. The tests are nearing completion, and the seats for the columns have been prepared.

The work has been superintended by Mr. A. Brownlee, to whom credit is due for the able and efficient manner in which he has fulfilled his duties.

Summary of cost of contract work.

Items.		Contract price.	Actual cost to contractor.
Piling	linear foot	$1.10	$0.90
Stringers	per M	90.00	108.15
Iron	per pound	.07	.05

Summary of cost of extra work of testing foundations:			
Average cost per linear foot of piling driven [a]			$2.02
Average cost per pile to test with driver			10.24
Average cost per column tested with weights [b]			28.33
Average cost per anchor rod in place			10.14
Contract work done to date:			
Piling driven	linear feet		482
Stringers in place	feet board measure		11,127
Iron in place	pounds		2,755
Estimates to date			$1,770.20
Extra work done:			
Piles tested by driver	number	59	
Column seats tested by weight	do	8	
Piles driven	linear feet	1,026	
Iron in place	pounds	1,345	
Payments to date			2,990.27
Grand total of estimates to date			4,767.47

APPROXIMATE ESTIMATE OF THE COST OF PASSENGER LANDING, UPON FINAL PLANS.

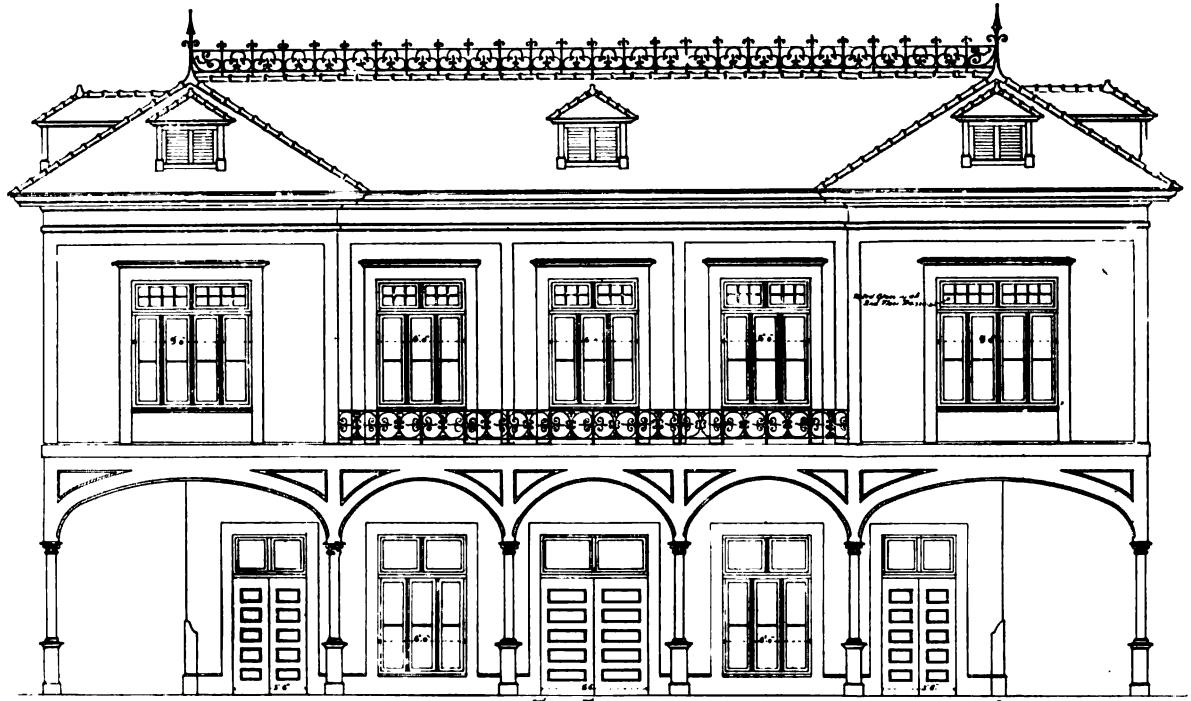
Foundation.

Piles.—20 piles 60′ long, 1,200 lin. ft., at $1 per lin. ft. for timber, and 50 cents per lin. ft. for driving; total, $1.50 per lin. ft		$1,800.00
Timber in foundation proper:	Feet B. M.	
7 sills 12″ x 12″ x 104′	8,736	
7 caps 12″ x 12″ x 86′	7,234	
2 caps 12″ x 12″ x 20′	480	
12 caps 12″ x 12″ x 4′	576	
80 corbels 6″ x 12″ x 3½′	1,680	
740 lin. ft. facing boards 3′ 3″ x 12″	2,220	
	20,926	

[a] The difference in cost between price for driving piles between contract and extra work is on account of the expensive splicing piles in leads which had to be done in driving piles down which failed to stand test, or because contractor could take advantage of driver moved on extra work.

[b] This price included cost of constructing platform and derrick, also cost of rope and pulley blocks for the entire test. The average appears high, as only eight column tests out of forty had been tested when this report was prepared, subsequent tests being done much cheaper.

Digitized by Google



FRONT-ELEVATION.

PASSENGER LANDING BUILDING
— HAVANA. —
Cuba.

1.

OFFICE OF CHIEF ENGINEER
DIV. OF CUBA.

Wm H. Black
Major, Corps of Engineers U.S.A.
Chief Engineer.

T.L. Morton
Asst. Engr.
July 1900.

Geo W. Armitage, Asst.

W.G.A. Worthen

No 1659

Digitized by Google

Digitized by Google

North Elevation facing San Francisco Street

PASSENGER LANDING BUILDING

HAVANA. —

Cuba

OFFICE OF CHIEF ENGINEER
DIV. OF CUBA.

Wm. H. Black
Major, Corps of Engineers, U.S.A.,
Chief Engineer.

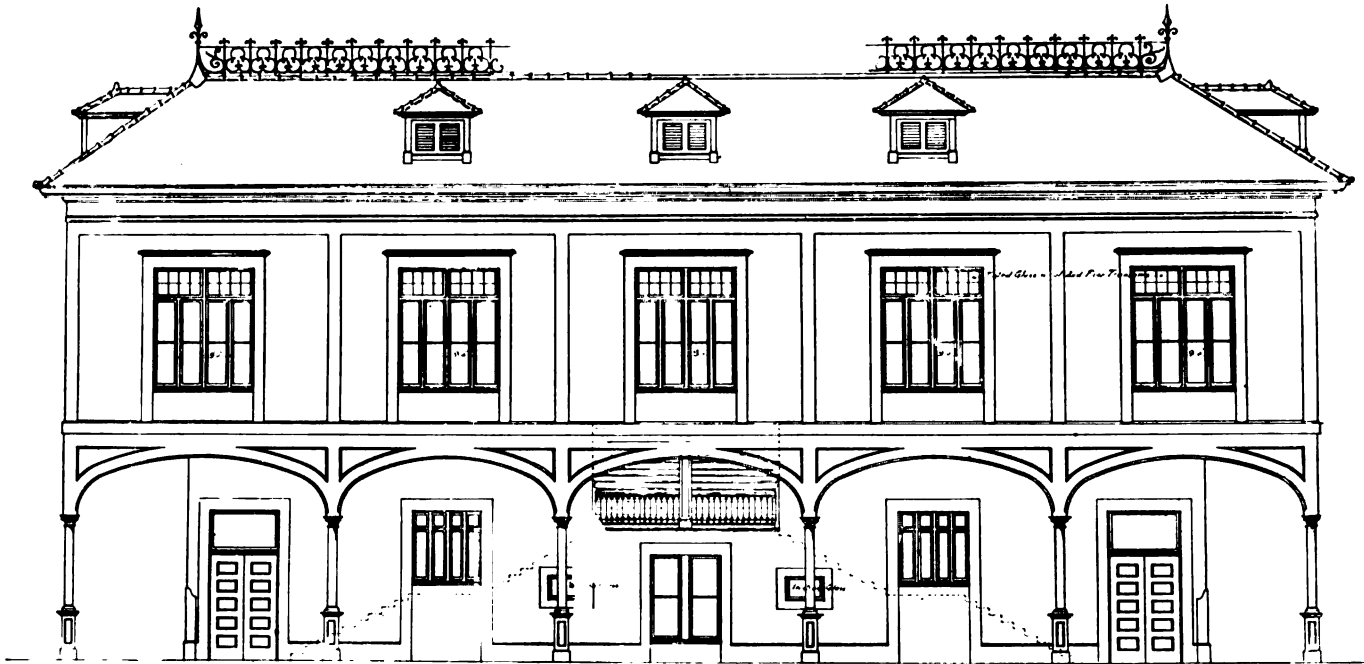
T. L. Hartley
Asst. Engr.
July 1900

2.

1657

Digitized by Google

Digitized by Google



South-Elevation facing the Bay.

PASSENGER LANDING BUILDING
— HAVANA —
CUBA

3.

OFFICE OF CHIEF ENGINEER
DIV OF CUBA

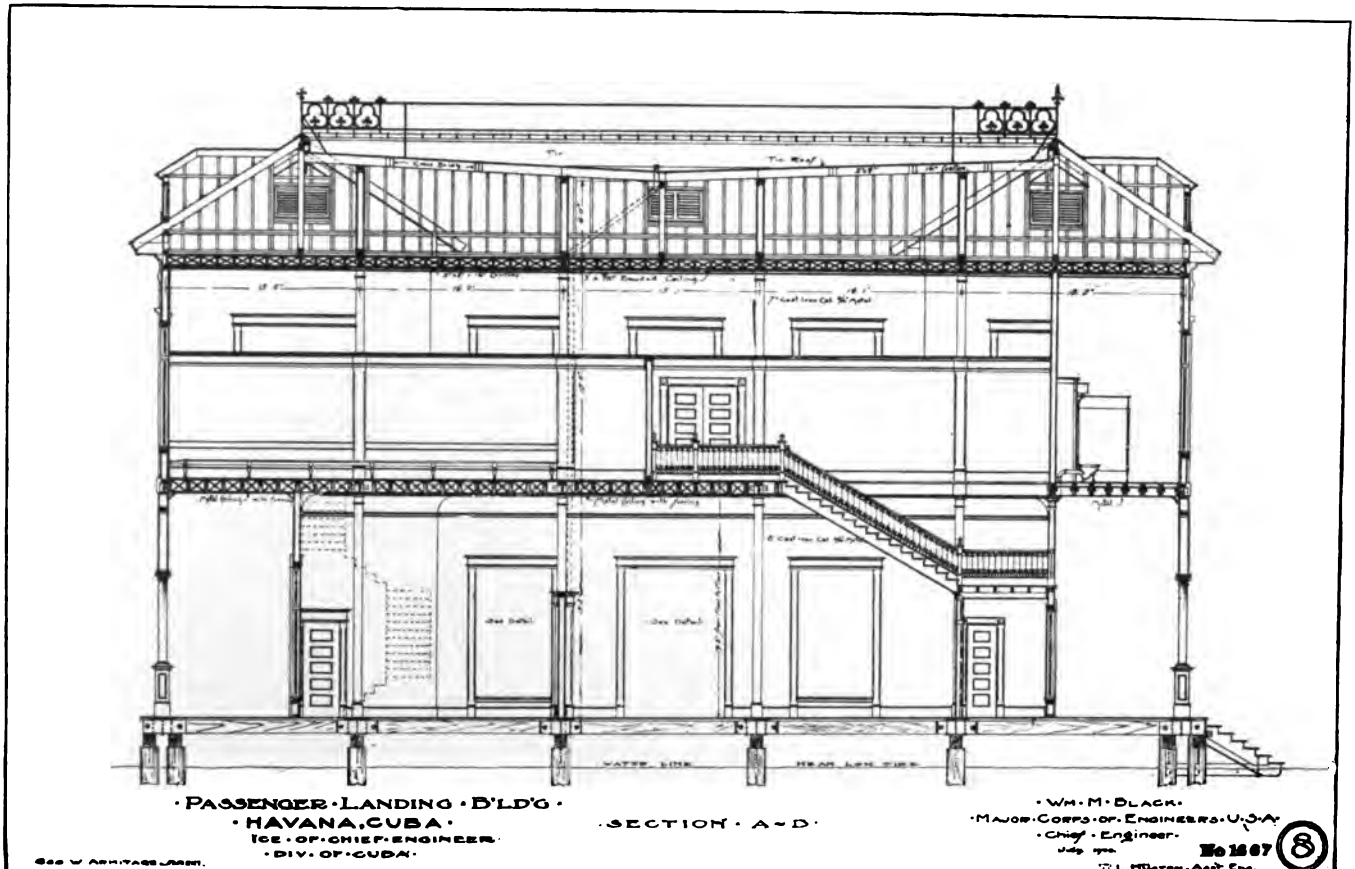
Wm M. Black.
Major, Corps of Engineers, U.S.A.
Chief Engineer

T.L. Hutton
Asst Engr.
July 1900

No 1658

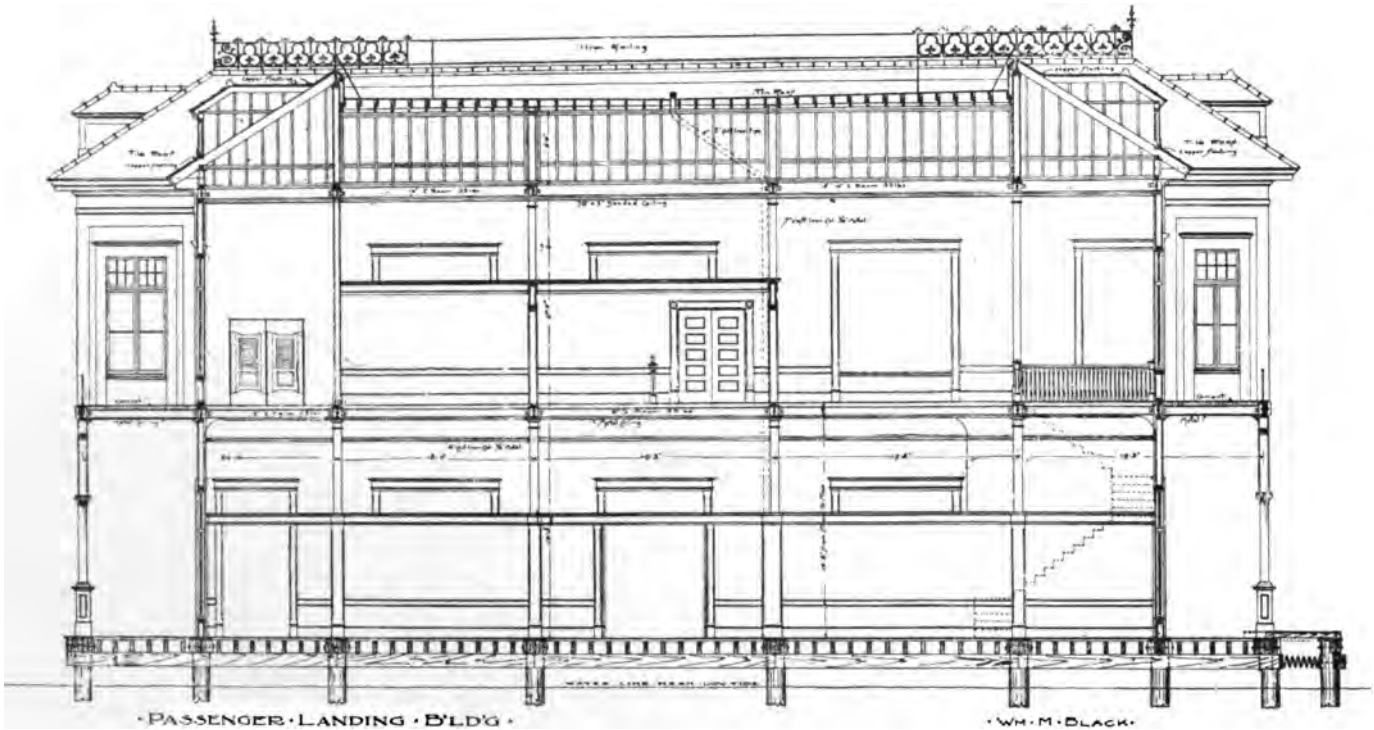
Digitized by Google

Digitized by Google


· PASSENGER · LANDING · B'LD'G ·
· HAVANA, CUBA ·
ICE · OF · CHIEF · ENGINEER ·
· DIV. OF · CUBA ·
· SECTION · A ~ B ·
· WM · M · BLACK ·
· MAJOR · CORPS · OF · ENGINEERS · U.S.A.
· Chief · Engineer ·
No 1807
8

Digitized by Google

Digitized by Google



·PASSENGER·LANDING·B'LD'G·

·HAVANA, CUBA·

·OFFICE·OF·CHIEF·ENGINEER·

·DIV·OF·CUBA·

·SECTION·C-D·

·WM·M·BLACK·

·MAJOR·CORPS·OF·ENGINEERS·U.S.A·

·Chief·Engineer·

·July 1900·

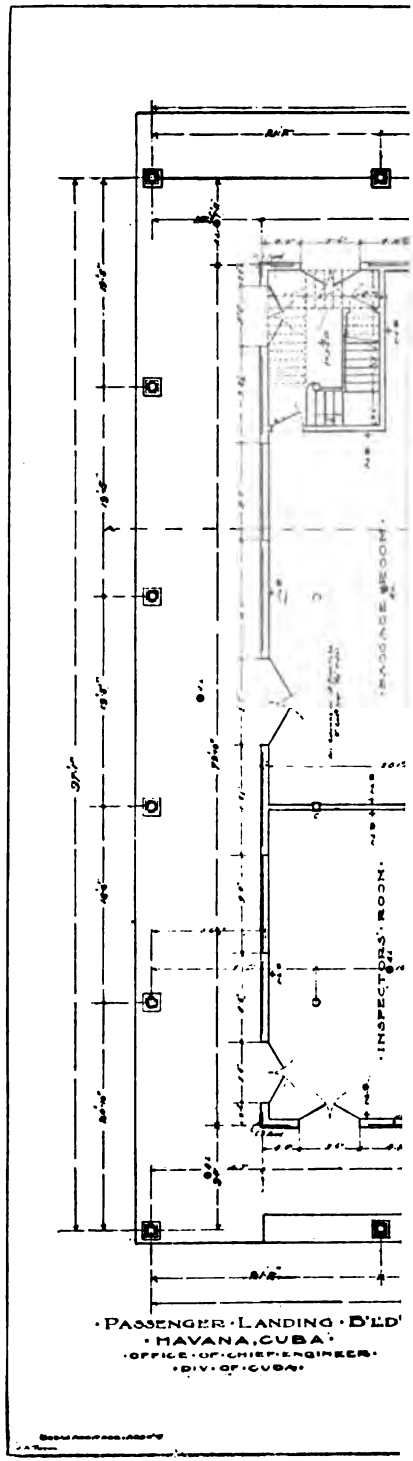
No 1666

9

T L HUSTON, Ass't Eng

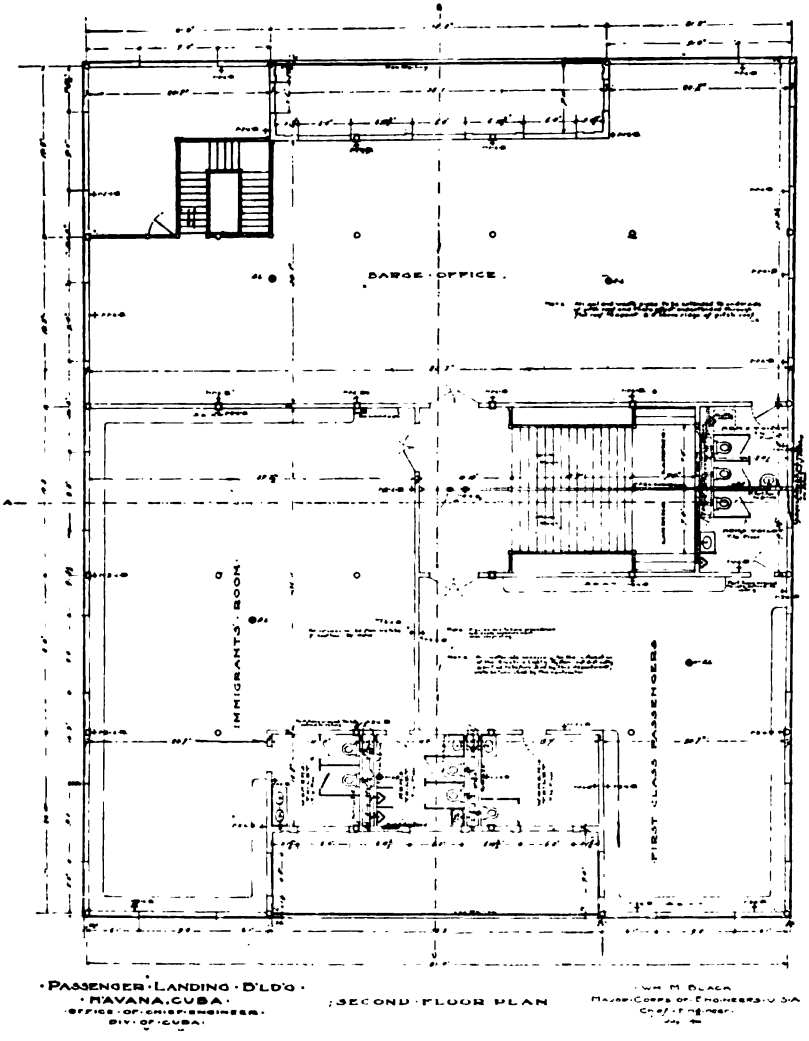
Digitized by Google

Digitized by Google



Digitized by Google

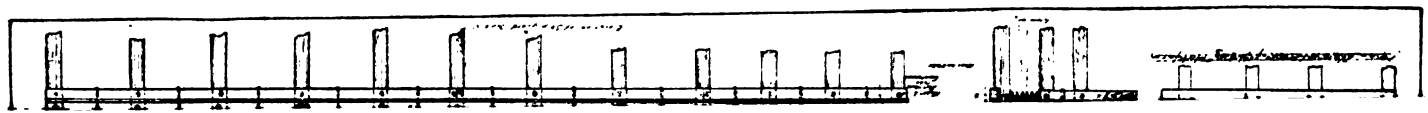
Digitized by Google



PASSENGER LANDING BUILDING, HABANA, CUBA.

Digitized by Google

Digitized by Google

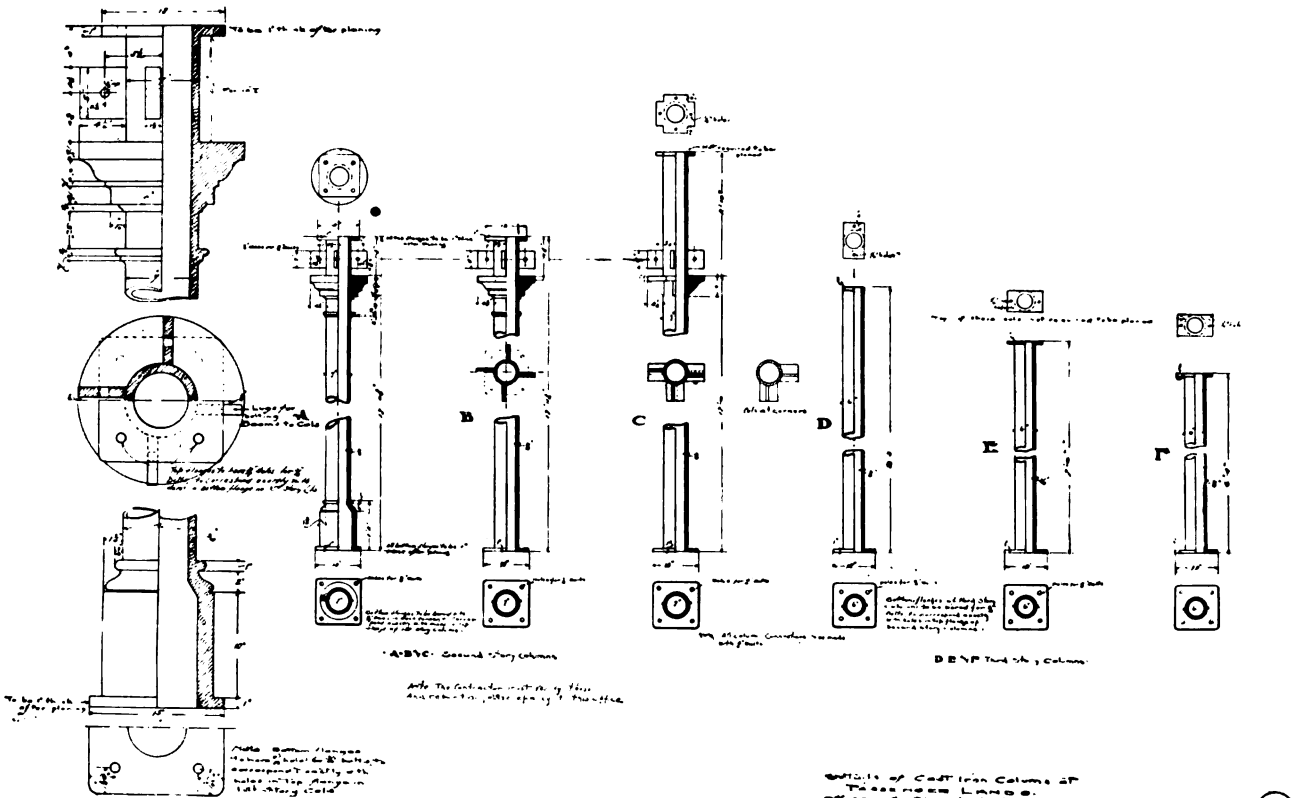


Sheet 2

No 1855

Digitized by Google

Digitized by Google

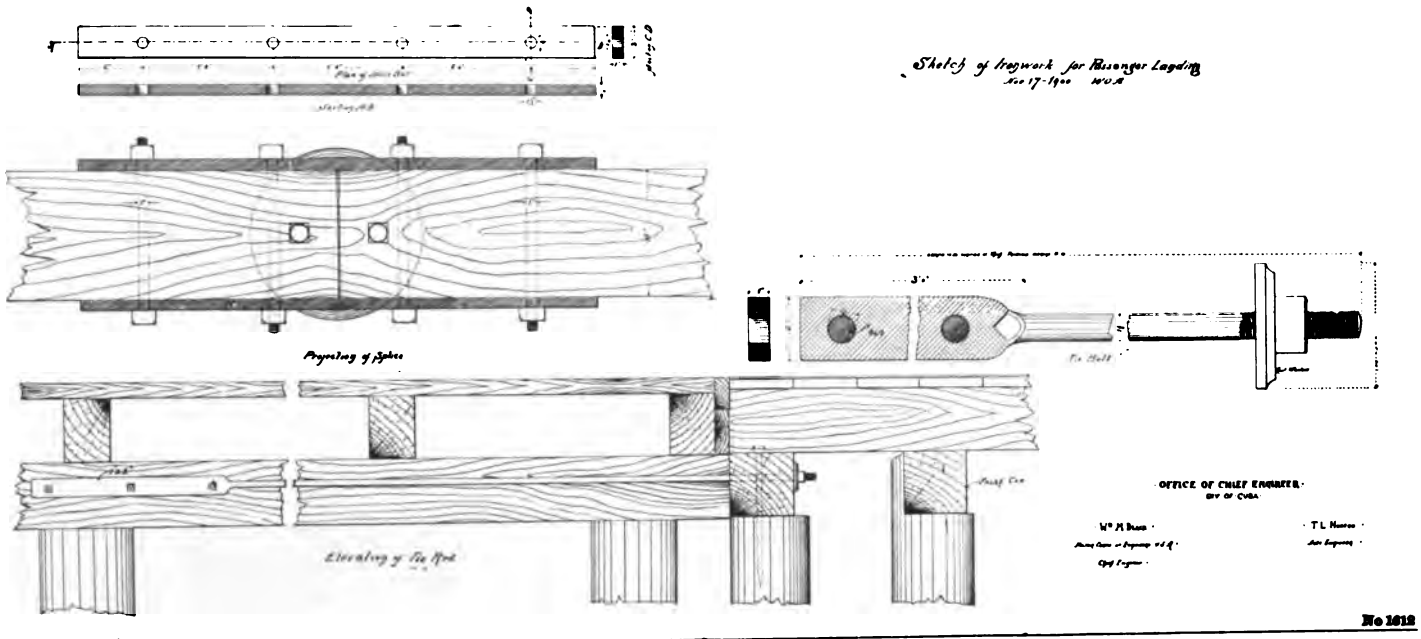


Sheet 2

No 1655

Digitized by Google

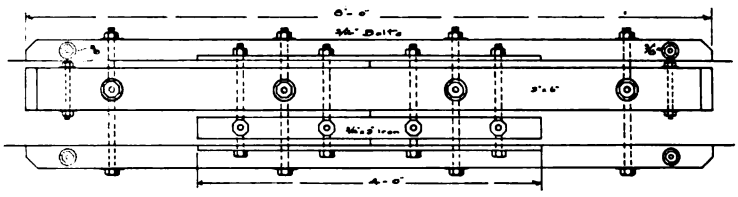
Digitized by Google



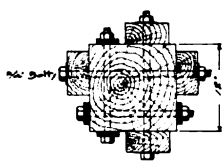
SKETCH OF IRONWORK FOR PASSENGER LANDING.

Digitized by Google

Digitized by Google



ELEVATION.



PLAN

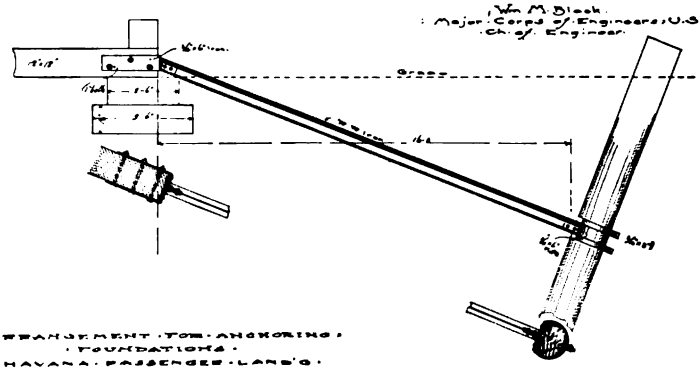
DRAWING SHOWING METHOD OF SPLICING JURAGUA TILES IN HAVANA PASSENGER LANDING

Office of Chief Engr. Dept. of Cuba

Wm. M. Black, Major Corps of Engineers, U.S.A. Chief Engineer

Geo. W. Armstrong Archt.

T. L. Hyffe, Asst. Engr.



ARRANGEMENT FOR ANCHORING FOUNDATIONS HAVANA PASSENGER LANDING

Office of Chief Engineer Dept. of Cuba

No 1612

Geo. W. Armstrong Archt.

T. L. Hyffe, Asst. Engr.

Digitized by Google

Digitized by Google

TESTING PILING, PASSENGER LANDING.

Digitized by Google

Digitized by Google

	Feet board measure.	
Steps:		
10 lookouts 6″ x 12″ x 10′	600	
10 carriages 3″ x 14″ x 6′	210	
6 treads 3″ x 14″ x 104′	2,184	
	2,994	
Fenders:		
2 pieces 12″ x 12″ x 86′	2,064	
6 pieces 3″ x 12″ x 86′	1,548	
42 pieces 4″ x 4″ x 7′	420	
	4,032	
Total timber in foundation, 27,952′ B M., at $97.50		$2,725.32

Iron work.

	Lbs.	
Foundation at columns:		
80 bolts with heads, nuts, and washers, 1″ x 13½″ U. H., at 4.26 lbs	341	
80 bolts with heads, nuts, and washers, 1″ x 25½″ U. H., at 8.52 lbs	682	
80 bolts with heads, nuts, and washers, 1″ x 24″ U. H., at 7.64 lbs	611	
40 bolts with heads, nuts, and washers, 1″ x 15″ U. H., at 4.48 lbs	179	
40 drift bolts, 1″ x 24″, at 6.8 lbs	272	
	2,085	
Piles where no columns occur:		
362 drift bolts, 1″ x 24″, at 6.8 lbs	245	
370 boat pikes, ¼″ x 6″, at 0.85 lbs	315	
36 bolts with heads, nuts, and washers, 1″ x 15″ U. H., at 4.7 lbs	170	
	730	
Steps:		
50 bolts with heads, nuts, and washers, 1″ x 18″, at 5.14 lbs	257	
10 bolts with heads, nuts, and washers, 1″ x 7′, at 16.7 lbs	167	
60 bolts with heads, nuts, and washers, ⅝″ x 4″, at 6.1 lbs	366	
60 boat spikes, ¼″ x 6″, at 0.85 lbs	51	
10 angles, 6″ x 6″ x 4″ x ½″, at 6.8 lbs	68	
	909	
Fenders:		
14 bolts with heads, nuts, and washers, 1″ x 18″ U. H., at 5.14 lbs	72	
14 bolts with heads, nuts, and washers, 1″ x 24″ U. H., at 7.64 lbs	107	
11 bolts with heads, nuts, and washers, 1″ x 26″ U. H., at 10.50 lbs	116	
6 car springs, 8″ x 36″, at 140 lbs	840	
83′ platform binding, 6″ x ¼″, at 6 lbs	500	
	1,635	
	5,359	
A total of 5,359 lbs. of wrought iron, at 5 cents		267.95
950 cast-iron washers, at 2 pounds, 1,900 pounds, at 5 cents		95.00
Total iron in foundation		362.95
Labor, tearing up flooring and floor beams, 84 squares, at $1		84.00
Labor, tearing up and removing heavy timber, 16,500′ B. M., at $10		165.00
Labor, replacing floor and floor beams, 84 squares, at $3		252.00
		501.00
Less value of heavy timber saved, 11,000′ B. M., at $15		165.00
		336.00
Total cost of foundation		5,224.27

STEEL "I" BEAMS, 2D FLOOR.

8″ beams, 23 lbs. per foot:	Ft.	in.	
2 20′ 1¾″	40	3½	
1 19′ 4½″	19	4½	
13 18′ 8½″	243	5½	
6 17′ 3¾″	103	10½	
4 10′ 4½″	41	7	
1 9′ 4½″	9	4½	
1 9′ ½″	9	½	
1 7′ 11½″	7	11½	
1 7′ 7½″	7	7½	
6 8′ 3″ (at porch)	49	6	
6 9′ 8″ (for concrete)	58	0	
Total length	590	1½	13,573
10″ beams, 25 lbs. per foot, 6 12′ 2½″	73	2½	1,830

Digitized by Google

	Ft.	in.	Lbs.	
12″ beams, 32 lbs. per foot:				
2 20′ 1½″	40	3½		
2 19′ ½″	38	1		
2 14′ 10½″	29	9½		
2 12′ 8½″	25	5		
2 9′ 7½″	19	3		
Total length	153	..	4,896	
12″ beams, 50 lbs. per foot:				
4 20′ 5½″	81	11		
2 17′ 5½″	69	11		
4 15′ 4½″	61	7		
2 15′ 3½″	61	3		
4 14′ 10½″	59	7		
4 14′ 5½″	57	11		
Total length	392	2	19,608	
12″ beams, 65 lbs. per foot, 4 17′ 5½″	66	11	4,490	

IRON WORK, ROOF FRAMING.

12″ beams, 40 lbs. per foot:				
4 20′ 1½″	80	7		
4 17′ 5½″	69	11		
Total length	150	6	6,020	
10″ beams, 35 lbs. per foot:				
2 20′ 5½″	40	11		
2 20′ 1½″	40	3½		
2 19′ 4″	38	8		
2 19′ ½″	38	1		
14 18′ 8½″	268	2½		
1 17′ 11″	17	11		
6 17′ 7½″	105	10½		
4 15′ 4½″	61	7		
4 15′ 3½″	61	3		
4 14′ 10½″	59	7		
4 14′ 4½″	57	7		
Total length	789	11½	27,648	
8″ beams, 23 lbs. per foot:				
2 14′ 10½″	29	9½		
2 12′ 4½″	24	9½		
4 10′ 4½″	41	7		
2 9′ 7½″	19	3		
Total length	114	5	2,632	
80,697 lbs., at $0.03				$2,420.98

BOLTS.

Roof:		
Columns, 135 1″ x 1½″ U. H., at 1.74 lbs	235	
Connections, 64 ½″ x ½″ U. H., at 0.66 lbs	42	
Second floor:		
Columns, 135 1″ x 1½″ U. H., at 1.74 lbs	235	
Connections, 344 ½″ x ½″ U. H., at 0.66 lbs	228	
Balcony, 14 rods ¾″ x 4′, 4½, at 7 lbs	98	
839 lbs., at $0.04		33.52

ANGLE CONNECTIONS.

Roof:		
4 for 8″ into 10″ beams, 6″ x 6″ x ⅜″ x 8 lbs	32	
4 for 10″ into 10″ beams, 6″ x 6″ x 6½″ x 9 lbs	36	
Second floor:		
44 for 8″ into 12″, 6″ x 6″ x 5″ x 8 lbs	352	
10 for 12″ into 12″—		
6″ x 6″ x 8½″ x 12 lbs	120	
Z bar at stairs 18′ 8″ long, at 23 lbs	430	
970 lbs., at $0.03½		33.95
Total "I" beams and connections		2,488.45

COLUMNS.

First floor:		
Outside columns—		
¾″ circular metal, 8″ in dia. outside, 55 lbs. to the foot, 19′ 2″ long	1,060	
3 lugs at 6 lbs., 18 lbs.; 3 brackets, 10½ lbs., 32 lbs	50	
Ornamental cap at spring of arch	250	
Large base and base cap	475	
Top flange, 27 lbs.; bottom flange, 158 lbs.	185	
	2,020	
16 of these at 2,020 lbs	32,320	
4 of these at porches, but only 19′ 1″ long 2,010 lbs	8,040	
	40,360	

Digitized by Google

	Lbs.
First floor—Continued.	
Inside columns—	
Columns with bases and caps weigh as follows: ¼″ circularmetal, 8″ on the outside, 19′ 3″ long	1,060
4 lugs, at 6 lbs	24
4 brackets, at 10 lbs	40
2 beads, 27′ long	8
10 caps, 9 lbs	90
Base	115
Top flange, 45 lbs.; bottom flange, 155 lbs	200
	1,587
9 of these, at 1,540 lbs	13,860
Columns with caps and without base weigh as follows:	
¼″ circular metal, 8″ outside, 19′ 3″ long	1,060
4 lugs at 6 lbs	24
4 brackets at 10 lbs	40
Top flange, 45 lbs.; bottom flange, 155 lbs	200
Cap	91
	1,415
7 of these, at 1,415 lbs	9,905
Without caps and base, figures same as preceding column, less 90 lbs. for cap. Four of these, at 1,325 lbs	5,300
Total weight of columns on 1st floor	69,425
Second floor:	
Outside columns without caps and base figure as follows: ¼″ circular metal, 7″ in diameter outside, 19′ 10″ long, at 46 lbs. per foot	912
4 lugs, at 6 lbs	24
4 brackets, at 10 lbs	40
Top flange, 28 lbs.; bottom flange, 155 lbs	183
	1,159
20 of these, at 1,160	23,200
Inside columns without caps and base figure same as above but are only 18′ long, making 2 columns, at 1,075	2,150
Inside columns—	
With caps but with no base column proper 18′ long, as preceding	1,075
Cap	90
	1,165
6 of these at 1,165 lbs	6,990
With caps and base column proper 18′ long	1,075
Cap	90
Base	115
	1,280
8 of these at 1,280 lbs	10,240
Total weight of columns 2nd floor	42,580
Roof columns—	
Plain columns 6′ 4″ long, ¼″ circular metal, 6″ outside, 48 lbs. per foot	304
Top flange, 27; bottom flange, 27	54
	358
4 of these at 358 lbs	1,432
Colums, roof, 7′ long, ¼ circular metal, 6″ outside	336
Top flange, 27; bottom flange, 27	54
	390
4 of these at 390 lbs	1,560
Columns ¼″ circular metal 8′ 3″ long	396
Top flange, 27; bottom flange, 27	54
	450
8 of these at 450 lbs	3,600
Total weight of columns for roof	6,592

Digitized by Google

Recapitulation.

	Lbs.	
Total weight of columns 1st floor	69,425	
Total weight of columns 2d floor	42,580	
Total weight of columns for roof	6,592	
	118,597	
Total: Columns, caps, and bases, at $0.03		$3,557.91
Labor on setting up iron work: One gang of a foreman, at $5; 2 men, at $2.50; 6 at $1, will take two days to each bent on each floor, and as there are 8 bents of two floors it will require 32 days to raise iron work. One gang of bolters of 1 man at $3 and 2 men at $2 will follow up bolting, etc., costing		736.00
20% for slips		147.00
Total		883.00
Derrick, etc		117.00
Total labor erecting iron work		1,000.00
Iron folding gates:		
3 gates 8′ 4″ wide x 6′ 0″	168	
3 gates 9′ 10″ wide	177	
1 gate 13′ wide	78	
2 gates 10′ 3″ wide	123	
2 gates 11′	132	
	678	
678 sq. ft. $1.50		1,017.00
Cast-iron wall plates to receive gates 4′ x 6″ x 1″—1 cu. ft. 450 lbs., at $0.04		18.00
4 cast-iron corner angle plates, 12″ x 12″ x 5½″ high x 1″ metal, 1,650 lbs., at $0.04		66.00
Balcony railing (price obtained from Havana shops):		
76 lin. ft. at $1.50		114.00
154 lin. ft. main stair case, railing at $2	$308.00	
16 C. I. newel post, 1,800 lbs., at $0.05	90.00	
		398.00
Total: Gates, railings, newel posts, etc		1,613.00
Cresting on roof:		
Per lin. ft. material		1.20
Labor, etc		.30
		1.50
270 lin. ft. at $1.50		405.00
100 ¾″ bolts for blocks on 8″ beams 4¼ U. H., at $0.21		21.00
Dogs at joists:		
128 16″ x 2½″ at $2.30 each		294.00
256 24″ x 2″ x ¼ at $3.50 each		896.00
Total to recapitulation		1,211.00
Iron work on trusses:		
	Lbs.	
4 rods ¾″ (round) with N. H. & W. 7′ 0″	64	
4 rods ¾″ (round) with N. H. & W. 9′ 2″	80	
196 ¾″ bolts 11″	240	
4 straps ¼″ x 9½″ x 3″	10	
4 bolts ¾″ (round) 14″	8	
4 bolts ¾″ 10″	7	
	409	
410 lbs. at $0.05	$20.50	
Total recapitulation		20.50

Carpenter work.

Second story flooring:	Feet B. M.	
59 beams 4 x 12 x 22′	1,298	
103 beams 4 x 12 x 20′	2,060	
59 beams 4 x 12 x 18′	1,062	
58 beams 4 x 12 x 12′	696	
9 beams 4 x 12 x 10′	90	
Total length	5,206	
5,206 lin. ft. 4″ x 12″		20,824
Over 8″ I beams—		
4 blocks 4 x 4 x 12′	48	
6 blocks 4 x 4 x 18′	108	
12 blocks 4 x 4 x 20′	240	
	396	

Digitized by Google

Second story flooring—Continued.	Feet B. M.	
396 lin. ft. 4″ x 4″	528	
600 pieces bridging 2″ x 3 x 2′	600	
16,000 lin. ft. 1 x 2 furring strips	2,667	
268 cove brackets 12″ x 12 x 1″	268	
856 lin. ft. molding 2 x 4	240	
	25,127	
25,127′ B. M. rough lumber, at $23		$577.92
Labor, 79 square beams, at $3		237.00
	Square feet.	
1″ x 6″ flooring	6,907	
1″ x 3″ flooring	6,907	
13,814′ B. M., at $28		386.79
		39.50
79 squares sheathing paper, at $0.50		
Labor, 79 squares sheathing paper, at $2		158.00
		197.50

Nails:	Pounds.	
10d nails for bridging and flooring	700	
8d nails for furring strips	126	
826 lbs. at $0.038		31.38
1,280 3″ screws, at $0.01½		19.20
		50.58
Total cost of second flooring, complete		1,149.79

Ceiling:	Lin. ft.	
65 ceiling joists 2 x 8 x 22′	1,430	
124 ceiling joists 2 x 8 x 20′	2,480	
62 ceiling joists 2 x 8 x 18′	1,116	
58 ceiling joists 2 x 8 x 12′	696	
	5,722	
	Feet B. M.	
5,722 lin. ft. 2″ x 8″	7,630	
60 pieces bridging 2″ x 5″ x 2′	600	
	8,230	
8,230′ B. M. lumber (rough), at $23		189.29
Labor, 79 squares, at $2.50		197.50
7,857′ B. M. 1 x 3 ceiling, at $28		220.00
Labor, 79 squares, at $1.25		98.75
Scaffolding, 1,600′ B. M., at $35		56.00
		761.54
	Pounds.	
Nails at bridging 10d	34	
Ceiling 8d	126	
	160	
160 lbs. nails, at $0.038		6.08
Total cost of ceiling		767.62

Roof:	Feet B. M.
172 pitch roof rafters, 2 x 8 x 20′	4,586
12 hip rafters, 2 x 8 x 26′	416
32 jack rafters, 2 x 8 x 18′	768
24 jack rafters, 2 x 8 x 16′	512
32 jack rafters, 2 x 8 x 14′	618
72 jack rafters, 2 x 8 x 12′	1,152
135 deck rafters, 2 x 8 x 20′	3,528
52 roof studding, 2 x 4 x 12′	416
6 roof studding, 2 x 4 x 18′	72
140 roof studding, 2 x 4 x 14′	1,190
47 roof studding, 2 x 4 x 14′	399
24 dormer rafter plates, 2 x 4 x 12′	192
16 dormer rafter plates, 2 x 4 x 20′	214
82 dormer rafter plates, 2 x 4 x 16′	876
1,300 lin. ft. bridging, 1 x 3	500
7,500 lin. ft. tile strips, 1 x 2	1,878
4 pieces truss top chord, 6 x 6 x 29′	348
2 pieces truss top chord, 6 x 6 x 32′	182
24 pieces truss bottom chord, 2 x 6 x 16′	384
12 pieces truss bottom chord, 2 x 6 x 18′	216
4 pieces end struts, 6 x 6 x 14′	133
12 posts, 6 x 6 x 9′	324
4 posts, 4 x 6 x 10′	40
6 posts, 4 x 6 x 8′	216
16 posts, 4 x 6 x 12′	584
	19,544

Digitized by Google

Roof—Continued.		
20,000′ B. M. lumber, at $23		$460.00
4,000′ B. M. dressed sheathing, at $28		112.00
40′ sqs. dry felt, 9 lbs., at $5.50		49.50
360 lookouts, at $0.20		72.00
300 lbs. 10d nails, at 0.038		11.40
Labor, 24,000′ B. M., at $15		360.00
12,150 roof tile, at $60		729.00
800 angle tile, at $100		80.00
Labor, 92 squares, at $2		184.00
Labor on angle tile, 14 days, at $4.50		63.00
43 squares tin roofing, at $7.30		313.90
90 lbs. solder, at $0.30		27.00
Labor, 43 squares, at $4		172.00
200 lin. ft. x 24″ 16-oz. copper, at $0.30		120.00
15 lbs. rosin		3.00
2 cu. meters mortar, at $8		16.00
Downspouts		35.00
		2,807.80
Studding:	Feet B. M.	
309 pieces 2 x 4 x 18′	3,708	
84 pieces 2 x 4 x 10′	560	
8 pieces 2 x 4 x 16′	86	
60 pieces 2 x 4 x 12′	480	
1,050 lin. ft. bridging, 1 x 3	350	
Partitions:		
520 pieces 2 x 4 x 18′	6,340	
32 pieces 2 x 4 x 16′	341	
132 pieces 2 x 4 x 10′	880	
1,500 lin. ft. 1 x 3 bridging	500	
	13,145	
14,000′ B. M. lumber, at $23		322.00
200 lbs. 10d. nails, at $0.0385		77.00
14,000′ B. M. labor, at $20		280.00
Total, framing		3,486.80
Doors (all measurements include finish):	Square feet.	
6 door frames and transoms, 7′ 3″ x 13′	754	
3 door frames and transoms, 9′ 9″ x 13′	380	
7 door frames and casings, 3′ x 8′ 3″	174	
3 door frames and casings, 5′ 6″ x 8′ 3″	136	
3 door frames and casings, 1′ 6″ x 8′ 3″	31	
1 door frame and casing, 5′ 6″ x 9′ 6″	53	
2 door frames and casings, 2′ 3″ x 8′	36	
1 door frame and casing, 2′ 8″ x 8′	20	
	1,584	
1,600 sq. ft. doors, at $0.75		1,200.00
Windows:	Square feet.	
20 windows, frame, sash, and glass, 10′ 9″ x 11′ 6″	2,473	
6 windows, frame, sash, and glass, 8′ 6″ x 1′ 6″	587	
12 frames and louvre, 4′ x 5′	240	
2 windows, frame, sash, and glass, 7′ 3″ x 7′ 6″	109	
2 windows, frame, sash, and glass, 3′ 6″ x 4′	39	
	3,448	
3,500 sq. ft., at $0.75		2,625.00
Total, doors and windows		3,825.00
Inside woodwork complete, in place:		
Main stairs complete, less iron railing		686.00
Rear stairs to barge office, including wood balusters		280.00
140 lin. ft. counter as per detail, at $75; 60 lin. ft. counter as per detail, at $75		150.00
646 lin. ft. cornice moulding, in 2 pcs., $0.30		193.80
995 lin. ft. picture moulding, at $0.10		99.50
1,236 lin. ft. chair rail, $0.10		123.60
1,236 lin. ft. base board, $0.20		247.20
200 lin. ft. partition cap and col. casing, $0.40		80.00
227 lin. ft. seat on wall, $0.60		136.20
Total, inside woodwork		1,996.30
Plumbing.		
First-floor toilet room:		
1 water-closet		54.00
1 wash basin		16.50
		70.50
Soil pipe—		
5′ 4″ soil pipe, at $0.25		1.25
5′ 2″ soil pipe, at $0.20		1.00
6 lbs. pig lead, at $0.04		.24
2 lbs. oakum, at $0.08		.16
		2.65

Digitized by Google

First-floor toilet room—Continued.	
Brass and lead work—	
1 4″ brass ferrule, at $0.75	$0.75
1 2″ brass ferrule, at $0.45	.45
5′ 1¼″ lead pipe, at $0.09	.45
5′ 4″ lead pipe, at $0.09	.45
4 lbs. solder, at $0.25	1.00
2 soldering nipples, at $0.75	1.50
10′ 2″ lead waste, at $0.09	.90
	5.50
Water supply—	
13′ ¾″ galvanized-iron pipe	1.56
1 ¾ x ½ x ¾ tee	.15
2 ¾ x ½ ells	.15
1 ¾″ gate valve	1.00
	2.86
Revent—	
40′ 2″ G. I. pipe, at $0.26	10.40
3 2″ ells, at $0.41	1.23
1 2″ tee, at $0.50	.50
	12.13
Labor roughing in	10.50
Labor for finishing	10.25
	20.75
Total, first-floor toilet room	114.39
Men's toilet room at head of landing:	
3 water-closets, at $43.50	130.50
1 urinal, at $38	38.00
1 wash basin, at $16.50	16.50
Soil pipe—	
60′ 5″ soil pipe, at $0.30	18.00
1 5″ x 4″ D. Y., at $0.95	.95
2 5″ ¼ bends, at $0.60	1.20
4 4″ ¼ bends, at $0.45	1.80
3 4″ Y's, at $0.75	2.25
2 4″ x 2″ reducing hubs, at $0.40	.80
1 2″ Y, at $0.36	.36
10′ 2″ soil pipe, at $0.20	2.00
112 lbs. pig lead, at $0.04	4.48
50 lbs. oakum, at $0 08	4.00
1 4″ cleanout, at $1.10	1.10
	221.94
Revent—	
41′ 2″ galv. iron pipe, at $0.26	10.66
6 2″ galv. tees, at $0.50	3.00
3 2″ x 1¼″ galv. ells., at $0.41	1.23
	14.89
Lead and brass work—	
3 4″ ferrules, at $0.75	2.25
4 2″ brass ferrules, at $0.45	1.80
3 4″ lead bends, at $0.80	2.40
12′ 1¼″ lead pipe, 60 lbs., at $0.09	5.40
6′ 2″ lead pipe, 30 lbs., at $0.09	2.70
3 2″ soldering nipples, at $0.75	2.25
4 1¼″ soldering nipples, at $0.50	2.00
21 lbs. solder, at $0.25	5.25
	24.05
Water supply—	
40′ 1″ galv. iron pipe, at $0.15	6.00
10′ ¾″ galv. iron pipe, at $0.12	1.20
1 1″ galv. tee, at $0.19	.19
4 1″ galv. ells, at $0.15	.60
5 1″ x 1¼″ x 1″ tees, at $0.19	.95
2 1″ x 1¼″ ells, at $0.15	.30
1 ¾″ x ½″ ell, at $0.15	.15
8′ ¼″ galv. iron pipe, at $0.08	.64
1 1″ gate valve, at $1.10	1.10
	11.13
Gasoline	5.00
5 per cent waste	4.60
	9.60

Digitized by Google

Men's toilet room at head of landing—Continued.

Labor—	
Labor for roughing	$45.50
Labor for finishing	32.50
	78.00
Iron partitions for 3 closets, at $30	90.00
Iron partitions for 1 urinal	10.00
	100.00
Total, men's toilet room	459.61

Women's toilet room, first class:

1 water closet	43.50
1 wash basin	16.50
	60.00
Soil pipe—	
60′ 5″ soil pipe, at $0.30	18.00
4 5″ ⅛ bends, at $0.60	2.40
1 5″ x 4″ Y, at $0.95	.95
1 5″ x 2″ tee, at $0.95	.95
2 4″ x 2″ Y's, at $0.75	1.50
2 4″ Y's, at $0.75	1.50
1 4″ brass cleaning screw, at $1.20	1.20
5 5″ D. H., at $0.40	2.00
60′ 2″ soil pipe, at $0.20	12.00
1 2″ sanitary tee, at $0.30	.30
1 2″ common tee, at $0.30	.30
2 lengths 4″ D. H. S. pipe, at $0.30	6.00
140 lbs. pig lead, at $0.04	4.16
50 lbs. oakum, at $0.08	4.00
	75.66
Revent—	
21′ 2″ galvanized pipe, at $0.26	5.46
3 2″ galvanized tees, at $0.50	1.50
4 2″ galvanized ells, at $0.41	1.64
	8.60
Brass and lead work—	
2 4″ brass ferrules, at $0.75	1.50
2 2″ brass ferrules, at $0.45	.90
2 4″ lead bends, at $0.80	1.60
12′ 2″ lead pipe, 60 lbs., at $0.09	5.40
4 2″ brass soldering nipples, at $0.75	3.00
14 lbs. solder, at $0.25	3.50
1 1¼″ soldering nipple, at $0.50	.50
	16.40
Water supply—	
30′ 1″ galvanized iron pipe, at $0.15	4.50
10′ ¼″ galvanized iron pipe, at $0.12	1.20
2 1″ galvanized ells, at $0.15	.30
1 1″ x ¾″ x 1″ tee, at $0.19	.19
3 1″ x ¼″ x 1″ galvanized tee, at $0.19	.67
1 1″ x ¼″ galvanized ell, at $0.15	.15
4 ¼″ galvanized ells, at $0.10	.40
8′ ¼″ galvanized pipe, at $0.08	.64
2 ¼″ galvanized ells, at $0.12	.24
1 1″ gate valve, at $1.35	1.35
	9.54
5 per cent waste	4.49
Gasoline	5.00
	9.49
Labor for roughing	45.50
Labor for finishing	13.00
	58.50
Iron partition 1 closet	30.00
Total, women's toilet room	247.79

Women and men's toilet room, second floor:

4 closets, at $43.50	174.00
2 urinals, at $48	96.00
1 slop sink, at $54	54.00
3 wash basins, at $16.50	49.50
	373.50

Digitized by Google

Women and men's toilet room, second floor—Continued.

Soil pipe—	
60′ 5″ soil pipe, at $0.80	$18.00
4 5″ ⅛ bends, at $0.60	2.40
1 5″ x 4″ Y, at $0.95	.95
1 5″ x 2″ tee, at $0.95	.95
3 4″ Y's, at $0.75	2.25
1 4″ x 2″ D. Y., at $0.80	.80
1 4″ x 2″ Y, at $0.70	.70
20′ 4″ D. H. soil pipe, at $0.30	6.00
6 5″ D. H., at $0.40	2.40
1 4″ cleanouts, at $1.10	1.10
1 4″ 3″ Y, at $0.75	.75
112 lbs. pig lead, at $0.04	4.48
40 lbs. oakum, at $0.08	3.20
	43.98
Water supply—	
30′ 1″ galvanized iron pipe, at $0.15	4.50
1 1 x ¾ x 1″ galvanized tee, at $0.19	.19
5 1 x ½ x 1″ galvanized tee, at $0.19	.95
1 1 x ½ galvanized ell, at $0.15	.15
3 1″ galvanized ells, at $0.15	.45
1 ¾″ galvanized ell, at $0.12	.12
5 ½″ galvanized ells, at $0.10	.50
1 1″ gate valve, at $1.35	1.35
	8.21
Revent—	
30′ 2″ galvanized iron pipe, at $0.26	7.80
5 2″ galvanized tees, at $0.50	2.50
5 2″ galvanized ells, at $0.41	2.05
5 2″ x 1½″ galvanized ells, at $0.41	2.05
	14.40
Brass and lead work—	
4 4″ brass ferrules, at $0.75	3.00
1 3″ brass ferrule, at $0.50	.50
2 2″ brass ferrules, at $0.40	.80
4 2″ soldering nipples, at $0.75	3.00
2 1½ soldering nipples, at $0.50	1.00
4 4″ lead bends, at $0.80	3.20
1 3″ lead bend, at $0.60	.60
8′ 2″ lead pipe, 40 lbs., at $0.09	3.60
8′ 1½″ lead pipe, 40 lbs., at $0.09	3.60
20 lbs. solder, at $0.25	5.00
	24.30
5 per cent waste	4.59
Gasoline	5.00
	9.59
Labor for roughing	58.50
Labor for finishing	45.50
	104.00
Iron partitions for 4 closets, at $30	120.00
Iron partitions for 2 urinals, at $10	20.00
	140.00
Water supply—	
170′ 1½″ galvanized iron supply, at $0.16	27.20
2 1½″ x 1″ x 1½″ galvanized tee, at $0.25	.50
1 1½″ galvanized ell, at $0.20	.20
3 1½″ x 1″ galvanized ells, at $0.20	.60
1 1½″ gate valve, at $1.92	1.92
Labor, 2 days, at $6	12.00
	42.42
Total, women and men's toilet room	760.40

Electric lights.

	Lights.
47–1–L brackets	47
18–2–L brackets	36
2–3–L chandeliers	6
1–2–L Newell	2
91 lights, at $7	$637.00
1 panel board for 15 circuits, complete	50.00
15 arcs, at $10	150.00
Total, to recapitulation	837.00

Digitized by Google

Expanded metal plastering.

	Square feet.	
2 coats:		
First story—		
Exterior walls	10,640	
Partitions	2,020	
At main stairs	1,328	
Second story—		
Exterior walls	19,550	
Main partitions	3,220	
Toilet room partitions	1,216	
Closet partitions	704	
	38,678	
Expanded metal, $3.50; staples, $0.25; mortar, $5; labor putting on expanded metal, $1.25; putting on plastering, $1.25.		
Total, 390 squares, at $11.25		$4,387.50
Putty or white coat—		
Mortar, $1.35; labor, $0.65.		
Total, 230 squares, at $2		460.00
Extra finish with cement at water-closets—		
Mortar, $4.35; labor, $0.65.		
Total, 7 squares, at $5		35.00
Total, to recapitulation		4,882.50
Ornamentation, etc.:		
391 lin. ft. main cornice, at $2		782.00
391 lin. ft. belt cornice, at $1		391.00
240 lin. ft. window caps, at $1.50		360.00
4,000 pilasters, windows, casings, bases, etc., at $0.25		1,000.00
Total, to recapitulation		2,533.00
Stamped metal ceiling:		
7,900 sq. ft. metal, at $0.07		553.00
700 lin. ft. molding, at $0.20		140.00
4,000′ molding, at $0.04		160.00
2,300′ molding, at $0.06		138.00
130 lbs. nails, at $0.05		6.50
Labor, 79 squares, at $5		395.00
Total, to recapitulation		1,392.50

Painting.

Iron work:		
I beams, 80,697 lbs.		
1 coat of red lead, at $0.001		$80.69
Columns, 118,597 lbs., at $0.001		118.59
Angle connections, 970 lbs., at $0.001		.97
Total for painting iron work		200.25
Roof:		
43 squares, 2 coats mineral, at $1.50		64.50
Cresting, 16.2 squares coats lamp black in oil, at $1.75		28.35
	92.85	
Balcony railing:		
4 squares 2 coats lamp black in oil, at $1.75		7.00
11 folding gates, 13.56 squares 2 coats lamp black in oil, at $1.75		23.62
	123.47	
Exterior work:		
Windows upper story, primed and painted 2 coats linseed oil and white lead, 25 sqrs., at $2.75		68.75
Iron columns, 1,080 sq. ft. (first story) 2 coats lead and oil, 10.8 squares, at $2		21.60
Windows in first story 1,107 sq. ft. filled and stained after sandpapering, varnished 2 coats Murphy's spar and rubbed, 11 squares, at $6		66.00
Doors, 900 square feet to be treated as preceding 9 squares, at $6		54.00
	210.35	
Interior woodwork:		
Filling and staining, varnishing, 2 coats Murphy's hard oil and rubbing as per specifications, 247 squares, at $4		988.00
Floors, oiling finished floors, 13,814 sq. ft., 138 squares, at $1		138.00
Stamped metal ceiling, 7,900 sq. ft., 2 coats lead and oil, 79 squares, at $3.50		276.50
	1,402.50	
Total, painting		1,936.57

Digitized by Google

Recapitulation of estimate.

Foundation complete	$5,224.27
Iron work:	
I beams and connections	2,488.45
Columns, caps and bases	3,557.91
Labor erecting same	1,000.00
Gates, rallings, newel posts, etc., in place	1,613.00
Roof cresting	405.00
Dogs at joists	1,211.00
Iron work on trusses	20.50
	10,295.86
Carpenter work:	
Second flooring	1,449.79
Ceiling	767.62
Framing	3,486.80
Doors and windows	3,825.00
Inside woodwork	1,996.30
	11,595.51
Plumbing and water supply:	
First floor toilet room	114.89
Men's toilet room at landing	459.61
Women's toilet room, first class	247.79
Women and men's toilet room, second floor	760.40
	1,582.19
Electric lighting	837.00
Expanded metal plastering	4,882.50
Ornamentation	2,533.00
Metal ceiling	1,392.50
Painting	1,936.57
	40,209.40
For any possible errors and omissions	1,000.00
Superintendent's incidentals, and unforeseen contingencies, 5 per cent	1,939.67
Total	43,149.07
Contractor's profit, 15 per cent	6,467.27
Total	49,616.34

MONSERRATE STREET BUILDINGS.

Estimate No. 1, for the demolition and removal of fourteen old houses on the west side of Monserrate street, built against the city wall..... $2,767

Project approved in civil file D. of C., No. 1635, July 11, 1900. O. C. E. file D. of C., No. 287.

The row of frame buildings on Monserrate street leaning against the old city wall, which divided it from Los Fosos, were in a very dilapidated and unsanitary condition and occupied by indigent families.

Upon request of Major Greble, superintendent of hospitals and charities, an estimate was prepared for their demolition and removal, amounting to $2,767, which was appropriated by the military governor July 11, 1900.

Although specifications were prepared in both Spanish and English, and published in the local papers of both languages, only one tender was received; that of Charles H. Thrall, for $2,160. He proceeded vigorously with the work, finishing on contract time.

The military governor deciding to convert the immediate vicinity into a park, it was found necessary to patch up retaining wall, separating site of houses from the street, and $27.75 was deducted from the amount due contractor.

Actual cost of demolition of buildings per cubical foot of contents below eaves, six-tenths of 1 cent.

Actual cost of excavation per cubic yard, $0.84.

Financial statement, monserrate street buildings:	
By allotment	$2,767.00
Contract	2,138.25
Inspection, etc	381.50
Disinfection	113.95
Balance	133.30
	2,767.00

Digitized by Google

PALATINO PUMPING STATION.

The superintendence of the erection of the Palatino pumping station to be located at Palatino, and which will contain the pumping machinery for supplying water to Quemados, Camp Columbia and Principe, Habana brewery, Cerro between Zaragoza street and United Railway tracks, Aldecoa Hospital No. 1, and Mercedes Hospital was placed in charge of this department at the commencement of the work on October 23.

Plans and specifications having previously been prepared by the department of superintendence and repair of municipal buildings, Messrs. Parker, Waugh & Co. were the successful bidders, and were awarded the contract at their price of $7,290.

The building covers an area of 42 by 69 feet and is 20 feet high to the top of the parapet wall on the outside; it is constructed of brick with stone trimmings, classical in design, with numerous arched openings spaced at even intervals in the walls with pilasters between. A hip roof, supported on trusses and topped by a Louvre ventilator extending the full length of the ridge, adds to the appearance of the structure.

The building contains pump room, 24 by 40 feet; boiler room, 26 by 40; coal room, 15 by 16; engine room, 15 by 15; bathroom and closet. Walls unplastered inside and outside excepting the interior of the engineer's room and bathroom, which will be finished and trimmed throughout. Glass and panel shutters and sash doors have been placed in the openings. All woodwork throughout to be finished in hard oil. A 75-foot brick chimney was built by the water and sewer department before work on the pump house began. The specifications provided for a building to be erected on the foundations to be laid by the engineer department. The water and sewer department built these foundations, which are of concrete.

Native brick, the best obtainable in the market, was called for in the specification, and at the time of the preparation of the plans and specifications, a very fair quality could be obtained. At the commencement of the work the contractor furnished native brick of an inferior quality. The brick was condemned by this department. A statement from the contractor, that he had furnished the best brick obtainable at that time, was found upon investigation to be correct. None of the brick originally intended for use could be found upon the market. By culling the native brick furnished by the contractor, it was found that a grade sufficiently good to construct the walls between the bearing piers could be secured, but it was thought advisable to use American brick in all the heavy piers and at the corners.

A proposal by the contractors, amounting to $150, to do this extra work, was forwarded to the military governor, with recommendation that it be accepted. Authority was obtained as requested on November 2 and executed accordingly. The contract required that the work be finished in forty-five working days, giving the contractor until December 5 to complete the work.

On November 30 a communication was received from the contractor requesting that he be granted an extension of thirty working days to complete the building, on the grounds that he had been delayed in his work by the failure of the department to finish the foundations in time for them to take advantage of the full time allowed them, and for other minor reasons. This extension was approved by the military governor on December 26. The building is nearing completion, but good work has been obtained only by strict superintendence.

Mr. C. C. Converse has been in charge of the work as superintendent. Total cubical contents of building, 46,024 cubic feet. Cost per cubic foot, $0.186.

HABANA SCHOOL OF PAINTING AND SCULPTURE.

Estimate No. 1, project returned with instructions to prepare plans and specifications and submit estimate for amount required for approval, $5,000.

See: Civil file D. of C. No. 4619, Sept. 22, 1900. O. C. E. file D. of C. No. 524.

On August 29, the secretary of public instruction forwarded to the military governor an application from the director of the Habana school of painting and sculpture, asking that certain additions and improvements be made at the government building occupied by this school at No. 62 Dragones street, in order that certain requirements necessary to the study of drawing and painting might be attained. There accompanied this application a sketch plan giving an outline of what was required.

The project as outlined was referred to the chief engineer for estimate of cost. This estimate, amounting to $5,000, was furnished by Capt. A. H. Weber, and was forwarded to division headquarters on September 2. On September 22, orders were received from the military governor to prepare detailed plans and estimates and a visit was made to the building occupied by the school with this end in view.

The building was found to be an old two-story structure in a fairly good state of

Digitized by Google

MONSERRATE STREET, AUGUST 25, 1900.

MONSERRATE STREET, JANUARY 21, 1901.

Digitized by Google

Digitized by Google

PALATINO STATION, NOVEMBER 9, 1900.

PALATINO STATION, JANUARY 7, 1901.

Digitized by Google

Digitized by Google

preservation. Besides being occupied by the school of painting and sculpture, it contains the public library of the city, in which may be found many old and interesting books and valuable maps.

The rooms occupied as studios were totally unfit for use as such, and yet on every hand could be seen creditable work and exhibitions of energy that became very commendable when the surrounding conditions were taken into consideration.

It was desired that two new studios be erected on the roof of the building, where excellent light and ventilation could be obtained. Measurements were taken, and detailed plans and estimate were made for two studios, size 18 by 40 feet and 18 by 58 feet respectively.

The structures were to be of metal, lath, and plaster construction, with cement floors and hip roof covered with asbestos roofing material.

The building will be well lighted by high windows and skylights, to be located on the north side of the structures. Interior wood work to be of yellow pine finished natural.

The estimate cost for this work was, $5,745.22. The project was not forwarded for approval, as it was decided that the structure should be made more permanent in character and fireproof absolutely.

Plans for brick structures with roofs of tile, but otherwise the same as outlined above, will be commenced shortly.

DRAGONES BARRACKS.

Estimate No. 1, for constructing correctional court, etc., $12,258.54. Project approved in: Civil File D. of C. No. 1236, August 16, 1900. O. C. E. File D. of C. No. 374–2.

Estimate No. 2, for concreting Patios, etc., $1,200. Project approved in: Civil File D. of C. No. 1236, November 2, 1900. O. C. E. File D. of C. No. 374–6.

Estimate No. 3, for stable drainage, etc., $650. Civil File D. of C. No. 4163, December 1, 1900. O. C. E. File D. of C. No. 374–10.

The correctional or police court of Habana has been, until lately, held at the old vivac, corner of Empedrado and Zulueta streets, but it being found necessary to institute another court for the proper dispensing of justice, the military governor on July 7, 1900, ordered an inspection and report with view to the advisability of installing a correctional court therein, with rooms for holding witnesses and prisoners.

A sketch of the proposed improvements was submitted to Major Pitcher, supervisor of police, consisting of the construction of a correctional court room, judge's room, clerk's room, two witness rooms, jury room, prosecuting attorney's room, main lobby and two prison rooms, with toilet accommodations in each. Also one private and one public toilet room, a complete vitrified sewer system connected to main sewer on Dragones street, wiring and fixtures for electric lights, nine dormer windows for light and ventilation, new floors throughout, and sundry other repairs which he concurred in.

Plans were then prepared for the entire work. The correctional court room and clerk's room are, in their essential features, similar to the police court rooms in Cincinnati, Ohio.

An approximate estimate of cost, together with above plans, was forwarded on August 10, 1900, for $12,258.54, the work to be done by government forces in order to expedite completion. The work was started August 21, 1900.

Sewers: All sewers were laid to a grade to produce a velocity of 3 feet per second and consisted of 350 linear feet of 6-inch vitrified pipe with clean outs, manholes, and fresh-air inlets placed at proper points.

Water supply: The water supply consisted of 2-inch inlet leading from tap on Escobar street to the center of the building, from which laterals were taken to supply fixtures, etc.

Plumbing: The plumbing was installed according to the rules governing plumbing in the city of New York, and consists of 10 water-closets, 4 urinals, 5 basins, and 1 sink. Six closets are of the washout type, porcelain bowl, oak seat, oak copper-lined cistern, nickel-plated flush pipe. The 3 water-closets in male prison room are the vitrified earthen with solid vitrified seat. Flush tank concealed back of 12-inch brick wall. The urinals are of porcelain with oak copper-lined autoflush tank. The basins are of enameled iron; the slop sink the same. The entire system was installed according to the most modern approved method, all properly trapped, vented, and back aired.

Prison rooms: The ceilings of the rooms now designated as the "prisoners' rooms" were in a bad condition, necessitating the placing of new rafters, also new ceiling of yellow pine. In that portion set off for the men's prison, 3 water-closets, 2 urinals,

Digitized by Google

and one wash basin were placed. Each water-closet is isolated by an iron-pipe partition covered with expanded metal and plaster, with doors. Two new iron doors were placed, one leading from large patio, the other into small patio, the former intended for the entrance of prisoners, the latter for an outlet to court room. A brick partition 12 feet high and 12 inches thick covered with plaster, with an iron grating above extending to ceiling, was erected to separate the men's prison from the women's prison, and a studding expanded metal plastered partition was constructed 2 feet from this in women's prison room; this forms an inclosed corridor for water-closet and urinal tank and connection, and prevents the possibility of prisoners' interference with same. In the women's prison room there are 2 water-closets and 1 wash basin. Each water-closet is protected by an iron-pipe partition covered with expanded metal and plaster; an iron grating reaching from floor to ceiling with gate for passage to court room; also an iron door at entrance from small patio. Entire new concrete floor was constructed in both rooms; also 3 new skylights protected inside with iron gratings to admit light to both compartments. The entire work was painted in keeping with use of rooms.

Judge's room: In the judge's room a complete new roof with a skylight was constructed; walls repaired; studding and expanded metal and 3 coats of plaster were used on the walls and ceiling, and new concrete floor laid. An opening was broken on Escobar street and glass-paneled cedar door put in for private entrance. Chair rail of cedar placed around walls, also an entrance door of cedar to rostrum; all woodwork varnished, and walls alabastined with dado of color in oil.

Court room: Court room is 55 by 20 feet. Doors were cut into prison room and prosecutor's office, and a large window converted into a door. The heavy rough 6 by 8 ceiling joists were rotten at bearings in west wall and were supported upon top flange of a Z bar, the bottom flange of which rested upon the wall with the web secured to wall by bolts passing through it and anchored on outside of wall. This arrangement was perfected with some difficulty and delay. The ceiling joists were covered with furring strips upon which was placed handsome paneling of Spanish cedar; a picture molding and chair rail were constructed of same material.

Some study was devoted to the treatment of the very large window openings in order to secure light, ventilation, and protection from rain, without marring the appearance of the room. The inside shutter was divided into four hinged panels; the upper part of panel was pivoted louvers, and the lower part of frosted glass, and in the case of one window which extended to the ground, the lowest part of panel was of wood.

An archway at the south end of court room was closed with an ornamental partition of Spanish cedar, glass, and wrought-iron grille work, with a wide door giving access to clerk's room. New cedar doors were also provided for the openings leading to prison, prosecutor's and toilet rooms.

On the north end of the court room was located the rostrum, composed of a platform 6 feet wide and extending across the room, with a set of steps at each end. On the highest part of this platform was placed the judge's bench, 8 feet 6 inches in length, and on each side, but a step lower, a witness stand surrounded by a railing. To add to the good architectural effect of this rostrum and as a background, a door at the rear leading to the judge's private room has been treated with handsome pilasters and a pediment, on the panel of which has been carved a scale, "Emblem of Justice."

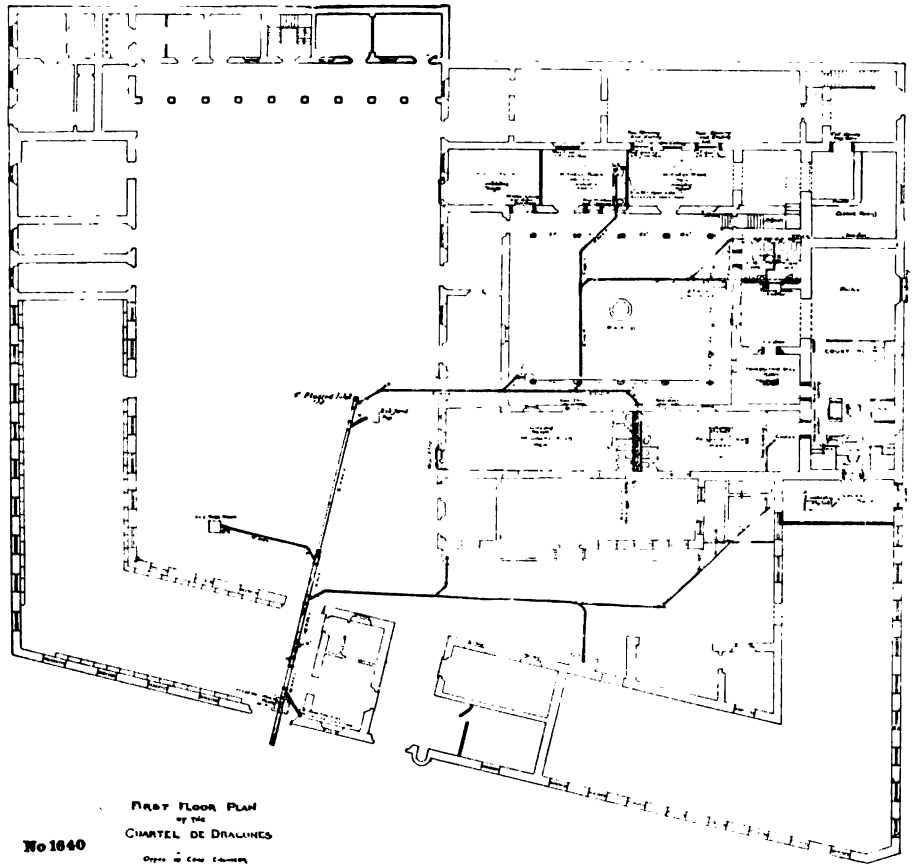
The balance of the furuiture comprises a low platform surrounded by a railing for use of jury of five men, and of a dock for the prisoners on trial. This dock was made semicircular in shape and movable, in order to be placed in the most convenient positions in regard to jurymen, witnesses and judge.

The court proper was divided from the space reserved to the public by a heavy railing, made like all the furniture and woodwork in the room, of carefully selected Spanish cedar.

Walls are tastefully decorated in oil to harmonize with the furniture and wookwork, which has received a natural oil finish instead of hiding its beauty by paint.

Clerk's room: The clerk's room is finished in a manner similar to the court room, and has a cedar counter with shelves below, dividing the room into an office and a lobby. An opening was cut in the main entrance and a double door placed therein and its counterpart placed in opening leading to corridor which leads to witness rooms. To afford floor space two columns were removed and ceiling supported by a 20-inch I-beam hidden under new ceiling. In the small room next to clerk's room a new ceiling and concrete floors were constructed. The prosecuting attorney's room was finished in a manner similar to the clerk's room with the addition of a dormer window. Galvanized-iron guttering with down spouts connecting with sewer were laced around entire inner patio. The entire roof was repaired, all broken tiles ng replaced with new ones.

Digitized by Google

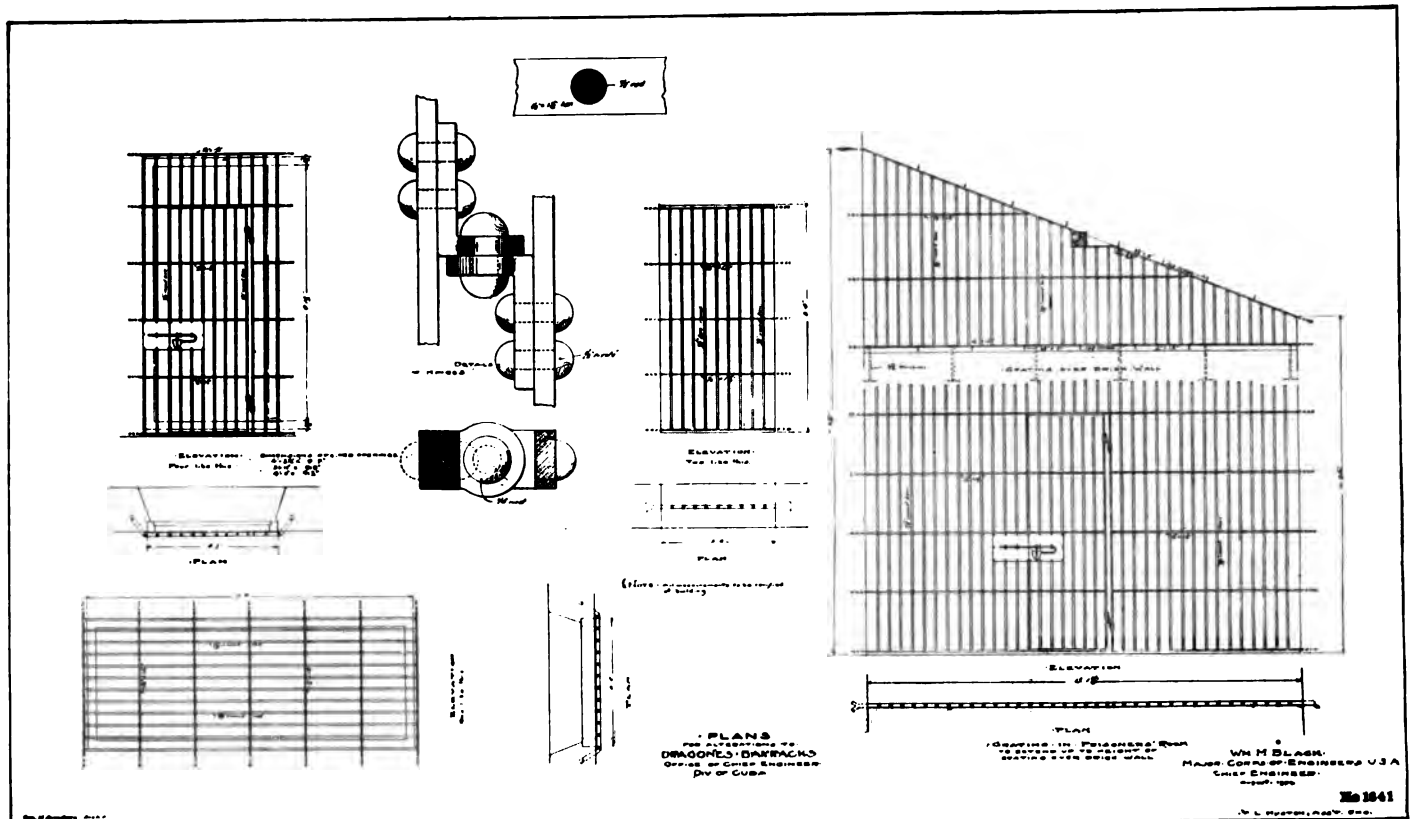


First Floor Plan
of the
Chartel de Draclines

No 1640

Digitized by Google

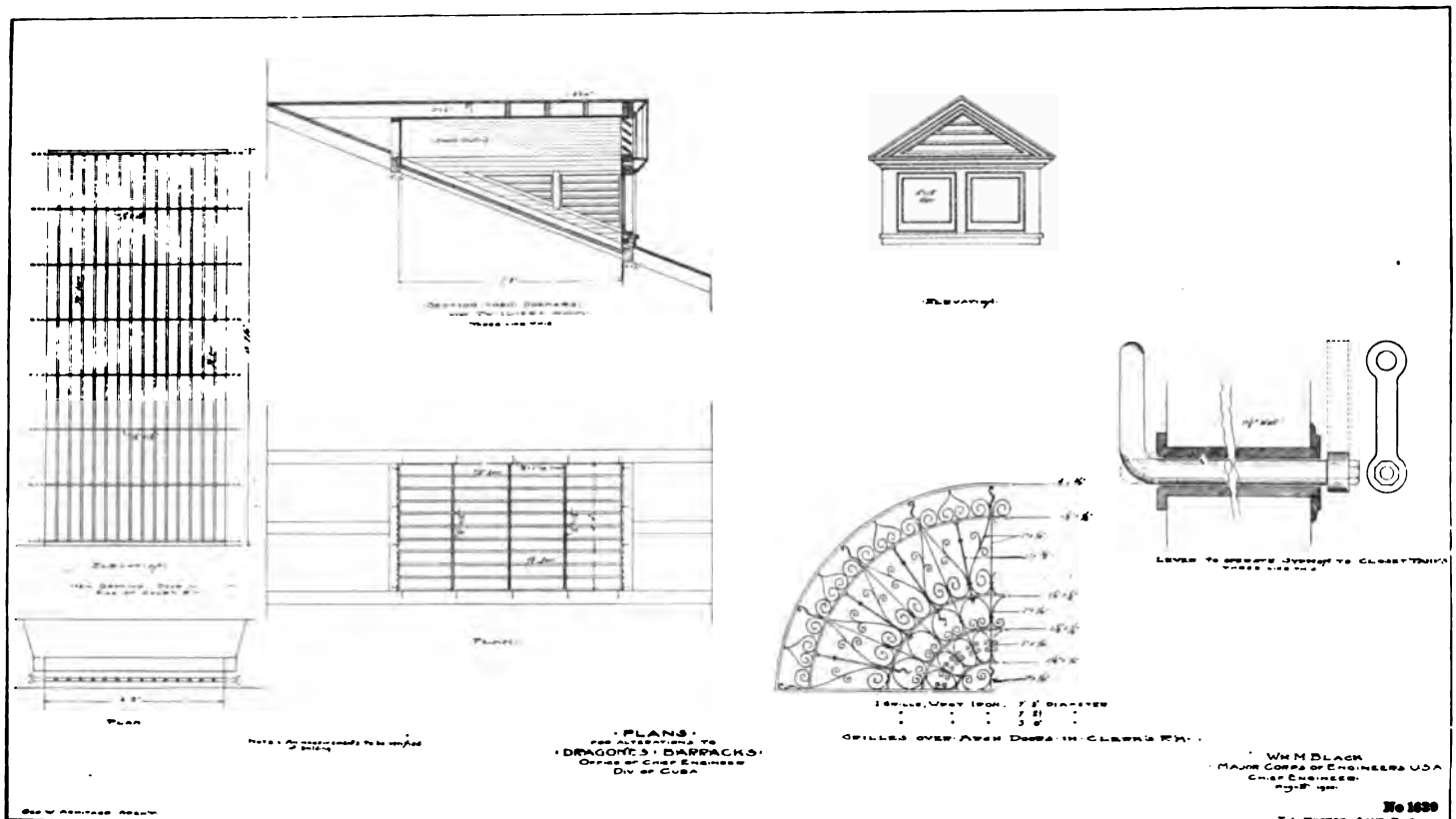
Digitized by Google



ALTERATIONS TO DRAGONES BARRACKS.

Digitized by Google

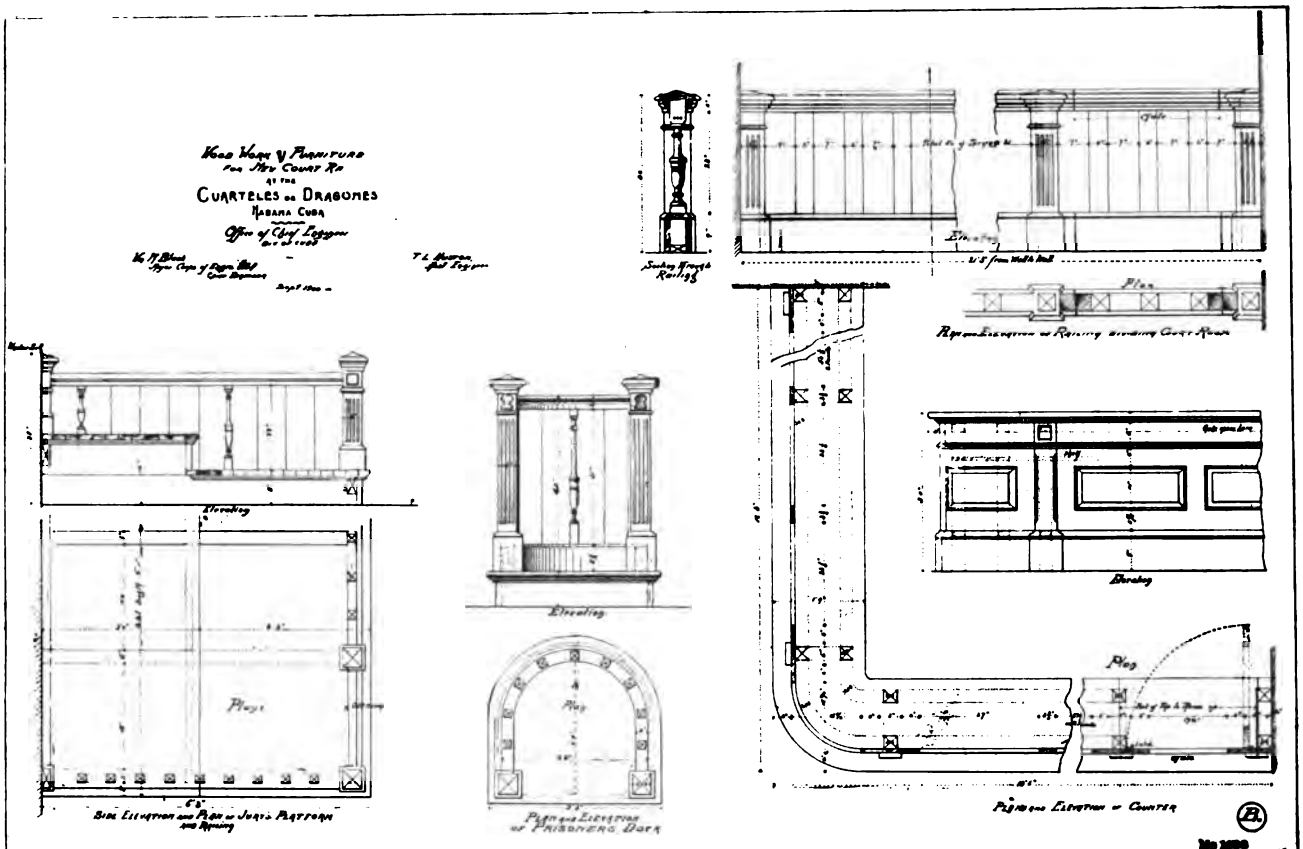
Digitized by Google



ALTERATIONS TO DRAGONES BARRACKS.

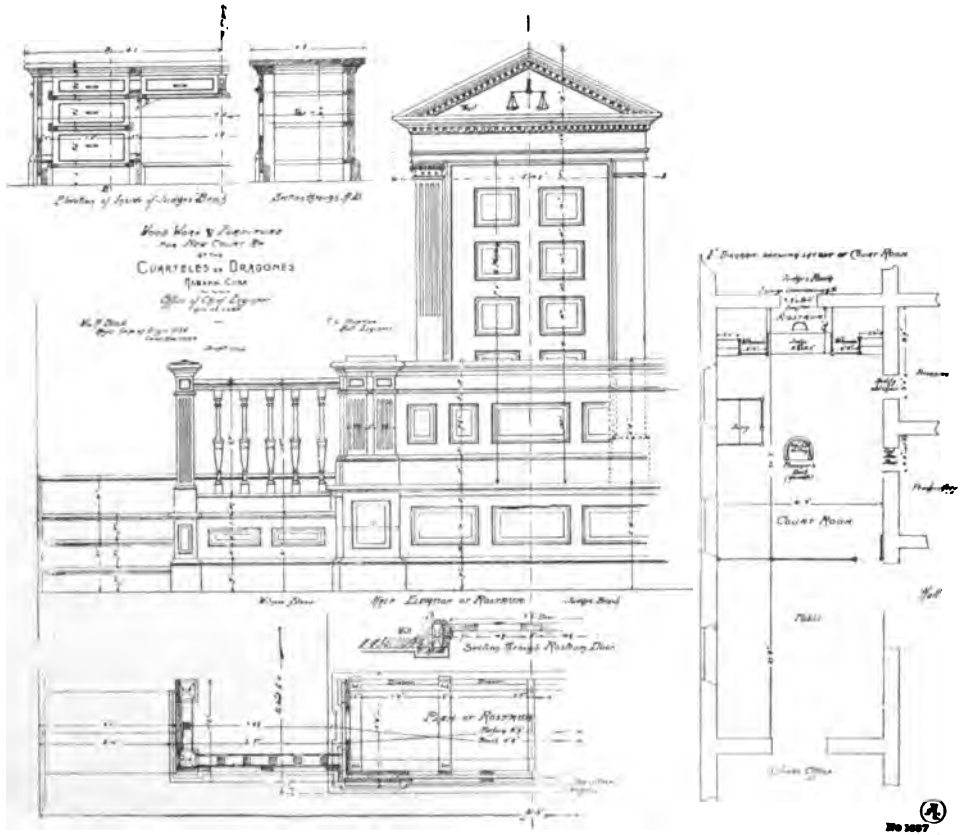
Digitized by Google

Digitized by Google



Digitized by Google

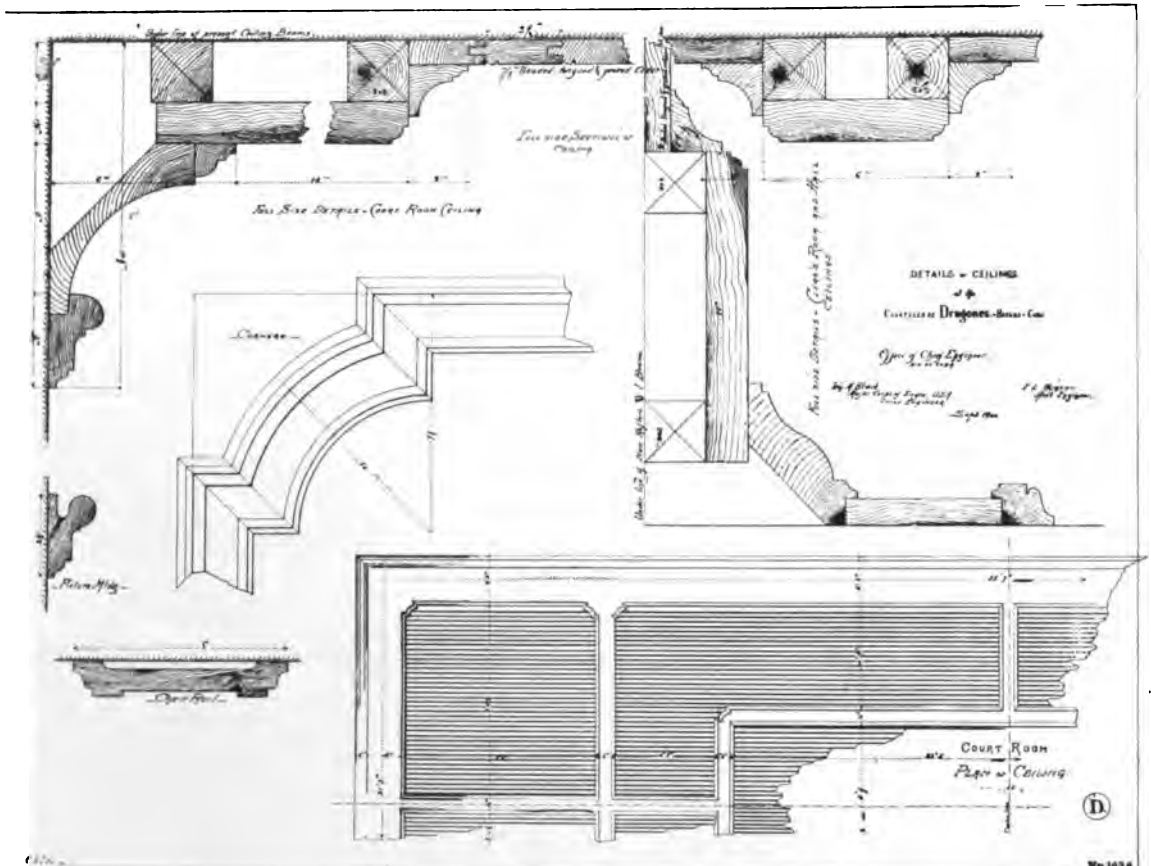
Digitized by Google



WOODWORK AND FURNITURE. DRAGONES BARRACKS.

Digitized by Google

Digitized by Google



DETAILS OF CEILING, DRAGONES BARRACKS.

Digitized by Google

Digitized by Google

DRAGONES BARRACKS, CORRECTIONAL COURT.

DRAGONES BARRACKS AND CORRECTIONAL COURT. CLERK'S ROOM.

Digitized by Google

Digitized by Google

DRAGONES BARRACKS. EXPANDED-METAL AND CEMENT-PLASTER PARTITIONS.

Digitized by Google

Digitized by Google

DRAGONES BARRACKS. PLUMBING, ROUGHING IN.

Digitized by Google

Digitized by Google

Men's witness room: In the men's witness room it was necessary to make new openings for windows and skylights. Yellow-pine ceilings were put in; a partition of wooden studding with expanded metal and plaster was built from floor to ceiling, separating this room from women's witness room.

Women's witness room: About the same work was done on this room, with the addition of wash basin and water-closet with partitions, both painted and alabastined.

Jury room: In the new jury room were constructed new yellow-pine ceiling, new yellow-pine doors, and a plastered partition which separates it from women's witness room. Varnished, painted, and alabastined.

Public and private water-closets: The public and private water-closets were divided by plaster partitions 12 feet high. In the former, 2 water-closets, 2 urinals, and 1 wash basin were installed. In the latter, 2 closets, 1 urinal, and 1 basin. Partitions of iron pipe with expanded metal and plaster and slat doors were placed in bath-rooms, separating lavatory fixtures. A new dormer window admitting light to both rooms was also constructed; new doors were placed at entrance of each room and painted in good form.

By verbal request of Major Caziarc, United States Army, superintendent of police, an estimate (No. 2) for concreting the large patio, the small patio leading off the main patio to the west entrance of stable, office entrance, prison entrance, witness and jury rooms, was submitted on October 22, 1900, and approved in second indorsement thereon November 2, 1900 Work to be done by Government forces in connection with other work there. Amount, $3,600. One thousand three hundred and forty-five yards of concrete were placed as indicated, consisting of 3½ inches of concrete, with one-half inch top of cement and sand. Same was turned over in good shape.

At the time the former estimates were submitted it was not understood to be the intention to use the old cavalry stables for sheltering the horses of the mounted members of the Habana police force, and as no request was made to provide for drainage of the stable, nothing was done in regard to it, excepting that a 6-inch plugged branch was installed in the sewer at the west end of the stables, so that a plumbing system could be extended to same at some future time.

On November 22, 1900, a report and estimate (No. 3) for $650 was submitted, as per order of chief engineer, for the sanitary improvement of the stable as requested by Major Caziarc, in civil file D. of C. No. 4163 and O. C. E., D. of C., No. 374–10.

This work will be done by Government forces and will include 160 yards concrete floors, 60 yards paving, 135 feet and 6 inches vitrified pipe, with the proper number of traps, laterals, etc.

System of electric wire and fixtures was installed to light the ten rooms herein described.

The interior of this building presents a neat and finished appearance, comparing favorably with some of the best of the kind in the large cities of the United States. M. M. Latta, general foreman in charge.

Items of cost.

Items.	Labor cost.	Material cost.	Total.
Concrete floors	$239.78	$665.07	$904.85
Per square yard	.31	.86	1.17
Ceilings, yellow pine:			
Jury room	22.50	15.77	38.27
Per 100 square feet	5.32	3.73	9.05
Prisoners' room	50.06	38.24	88.30
Per 100 square feet	3.85	2.85	6.70
Women's witness room	22.75	9.83	32.58
Per 100 square feet	7.41	3.20	10.61
Men's witness room	19.25	13.33	32.58
Per 100 square feet	4.91	3.40	8.31
Ceilings, cedar:			
Court room	204.57	280.25	484.82
Per 100 square feet	25.57	35.03	60.60
Clerk's room	111.95	133.30	245.25
Per 100 square feet	10.20	13.33	23.53
Prosecuting attorney's room	51.83	76.04	127.87
Per 100 square feet	29.96	43.95	73.91
Entrance hall room:			
Small patio	45.25	83.81	129.06
Per 100 square feet	18.47	34.21	52.68

Digitized by Google

PLUMBING.

Public and private water-closets:		
4 washout closets, at $17.50		$70.00
2 porcelain urinals, at $20		40.00
2 enameled wash basins, at $18.50		37.00
1 slop sink, at $18		18.00
Pipe specials supplies		82.37
Labor		100.79
		348.16
Average cost per fixture		38.69
Women's witness room:		
1 washout closet		18.25
1 enameled-iron wash basin with back, 2 sides, and tray		37.00
Pipe specials supplies		49.33
Labor		34.05
		138.63
Average cost per fixture		69.31
Prisoners' room:		
5 vitro closets with special pulls projecting through partition, at $26		130.00
2 porcelain automatic urinals, at $18		36.00
2 enameled-iron basins, 1 with back and side for soft corner, at $11		22.00
Pipe specials and supplies		67.19
Labor		88.56
		343.75
Average cost per fixture		38.19
Iron pipe partitions covered with expanded metal and plaster; 4 urinal partitions, 5 feet 3 inches by 2 feet—		
Labor cost	$18.48	
Material cost	23.99	
		42.47
Cost per square foot	.50	
Iron pipe partitions covered with expanded metal and plaster; 9 water-closet partitions, with doors and pilasters, 5 feet 3 inches by 4 feet 6 inches—		
Labor cost	46.97	
Material cost	76.03	
		123.00
Cost per square foot	.57	
Closet doors, per square foot	.90	
Pilasters, do	.12	
8 galvanized-iron gutters with 5-inch down spouting, erected, per linear foot	.28	
Iron gratings, ready to erect, per square foot	.80	
Iron grills, ready to erect, do	8.00	
Iron doors, ready to erect, do	2.00	
Cost to erect, do	.09	
Six-inch sewers:		
Labor cost	133.98	
Material cost	229.34	
		463.32

Labor cost, 38 cents per linear foot; material cost, 65 cents per linear foot, or, total, $1.03 per linear foot.

Statement of item costs at Dragones barracks as per estimate No. 2.

	Labor.	Material.	Total.
Grading	$160.97	.....	$160.97
Breaking stone	18.36	.....	18.36
Sewer connections	13.01	$22.96	35.97
Repairing roof	22.66	12.80	35.46
Construction water trough	13.05	6.40	19.45
Placing water pipe	26.00	20.28	46.28
Construction concrete floors	330.42	1,236.59	1,567.01
Construction brick driveway	53.54	394.88	448.42
Foreman, watchman, and timekeeper	196.51	.....	196.51
Cart hire	87.50	.....	87.50
General repairing	48.02	24.60	72.62
Total	970.04	1,718.51	2,688.55

1,365 square yards concrete floors cost $1,567.01, or $1.14¾ per square yard, or 24½ cents per square yard for labor and 90½ cents per square yard for material. 130 square yards brick driveway cost $448.42, or $3.45 per square yard, or 41 cents per square yard for labor and $3.04 for material.

Habana Institute: Estimate No 1, for renovating and repairing third floor, $1,297.25. Project approved in civil file D. of C. No. 5026, O. C. E. file D. of C. No. 555.

Digitized by Google

Complying with the verbal instructions of the division commander, the Habana Institute, located on Obispo street between Mercaderes and San Ignacio streets, was visited. A plan of the third floor, formerly occupied by the Catholic clergy, was made and an estimate prepared for renovating and repairing these apartments. The place was found to be in a dilapidated condition. The floor and roof beams, where they enter the walls, were found much decayed and worm-eaten. The doors and windows were in a bad state of repair, the glass being broken in many places. The estimate provides for new floor, repairing doors, windows, and closet, cleaning, whitewashing, and painting, and installing new wash basin and sink. The project was approved September 18, but a long delay followed, until December 19, on account of reconsideration as to the scope of work to be done. It was finally decided to execute the work by hired labor and purchase of materials in open market, as originally projected. Plans have been perfected to make the necessary repairs, so that the rooms can be utilized for school purposes. The work is now under way and will be completed about the middle of January, 1901.

Estimate:

100 squares of whitewashing, at $1	$100.00
35 squares of painting, at $3	105.00
150 tile in place	9.00
1,100 square feet of flooring	66.00
Thirty-five 3 by 8 by 16 feet yellow-pine joists	67.20
1 beam 4 by 8 by 45 feet, 120 feet, and labor, at 20 cents	24.00
1 new ceiling 15 by 21 feet	22.05
Repairing 17 windows, at $2	34.00
Repairing 7 doors	14.00
Repairing 2 door shutters	8.00
Repairing locks, hardware, etc	20.00
Changing urinal	25.00
Repairing closet	35.00
75 squares of roofing repaired, at $4	300.00
1 new waste bowl and sink	80.00
Cutting out and placing 1 new door for urinal	20.00
10 pairs of new shutters	175.00
	1,104.25
Disinfecting and hauling rubbish, etc	75.00
	1,179.25
10 per cent for incidentals, etc	118.00
	1,297.25

Santiago school: Estimate No. 1, for preparing plans and specifications, $650; project approved in civil file D. of C. No. 5419, October 12, 1900; O. C. E. file D. of C. No. 626. Estimate No. 2, for constructing a modern school building at Santiago de Cuba, $50,155.80; project approved in civil file D. of C. No. 5419, October 13, 1900; O. C. E. file D. of C. No. 626.

In order to reduce contingencies to a minimum, thereby encouraging intelligent bidders, specifications shorn of technicalities were drawn to cover every point, payments therein specified were liberal; being 90 per cent of engineer's estimate and the plans being complete, there being thirty prepared. Drawings include plans, elevations, scale, and details, showing the construction of all parts of the building in every detail, and every feature of the plan and style of construction employed was carefully considered by the chief engineer, in connection with Lieutenant Hanna, aid-de-camp to the military governor, who has taken throughout great interest in this, the first modern schoolhouse upon the island of Cuba. The estimate was close as regards the several items, but a good profit was allowed for the contractor. The project was forwarded to the military governor, and was approved by him on November 2.

Bids were advertised for in several papers in Cuba and the United States, between November 15, and December 8. Notwithstanding this fact, on December 15, the day of the opening of the bids, but one bid was received. This bid was for $50,000, and was presented by Mr. Sylvester Scovel. Recommendations were made to the military governor, that the contract be awarded to Mr. Scovel, and that in view of the fact that this work of constructing the school would be done under the supervision of Lieut. S. D. Rockenbach, of Santiago, that he be made the contracting officer. These recommendations were approved by the military governor on December 19, 1900, and Mr. Scovel was notified to sign contract and proceed with the work. Of the $50,000, the amount required to build this school, $20,000 was donated by the city of Boston; the remaining $30,000 will be provided from revenue funds. Cost of school per cubic foot at contract price, $0.1907.

Digitized by Google

Estimate of cost of six-room school building to be erected at Santiago de Cuba.

Excavation, 200 cubic yards, at $0.50		$100.00
Foundation, 109 cubic yards concrete, at $5.50		599.50
Stonework, 703 cubic yards cut stone in place, including carving, at $16		11,248.00
Water proofing for floors:		
5,248 pounds asphalt saturated felt, per 100 pounds f. o. b. Santiago, at $3.75	$196.80	
12 tons asphalt cement, per ton f. o. b. Santiago, at $47	564.00	
Labor laying 82 squares, at $2 per square	164.00	
		924.80
Concrete floors and pavement:		
First floor 112 cubic yards in place, at $5.50	616.00	
Second floor 800 square yards expanded metal lath No. 10 steel No. 3 mesh per yard in place, at $0.65	520.00	
800 square yards cement floor, at $1.60	1,280.00	
Porch, 319 square yards cement pavement, at $1.60	510.40	
		2,926.40
Iron work:		
84,763 pounds I-beams and channels in place, at $0.04	3,390.52	
5,131 pounds plates and bolts in place, at $0.06	307.86	
3,764 pounds C. I. in place, at $0.05	188.20	
		3,886.58
Lathing and plastering:		
500 square yards expanded metal, at $0.50	250.00	
570 square yards expanded metal in partition, at $0.35	199.50	
1,235 square yards plastering on ceiling, at $0.65	802.75	
570 square yards plastering on partitions, at $0.65	370.50	
1,074 square yards plastering on stone walls, at $0.65	698.10	
		2,320.85
Stud partitions, 3,300 square feet stud partition, at $0.035		115.50
Slate blackboards:		
147 square feet double-faced slate, at $0.40	58.80	
511 square feet single-surface slate, at $0.30	153.30	
		212.10
Doors and windows:		
529 square feet sliding door surface, at $0.75	396.75	
1,195 square feet swinging door surface, at $0.60	717.00	
2,904 square feet window openings, at $0.75	2,178.00	
		3,291.75
Flooring first floor:		
4,764 feet B. M. cypress sleeper, at $0.035	166.74	
7,056 square feet rift sawed flooring, at $0.10	705.60	
		872.34
Finish in vestibule:		
6¼ square yards flooring in vestibule, at $12	78.00	
52½ square feet wainscoting in vestibule, $1.50	78.75	
48 square feet door surface in vestibule, at $1.50	72.00	
21 linear feet cornice in vestibule, at $1.75	36.75	
63 square feet woodwork around mullion windows, at $1.50	94.50	
12 square feet woodwork side panels, at $1.50	18.00	
16½ square feet beveled plate chipped glass, at $2	33.00	
Carving 8 caps, at $2.50	20.00	
Carving 2 panels, at $4	8.00	
		439.00
Staircase, 30 treads, at $25		750.00
Roofs:		
130 squares in main roof, at $34	3,120.00	
52 squares in porch, at $24	1,248.00	
		4,368.00
Porch:		
480 linear feet cornice, at $1.50	720.00	
480 linear feet inside face cornice, at $0.50	240.00	
54 columns, at $15	810.00	
4,800 square feet matched ceiling, at $0.06	288.00	
		2,058.00
Ventilators:		
432 linear feet, at $1	432.00	
432 sheet copper in place, at $0.50	216.00	
		648.00
Interior finish		641.50
Ornamental ironwork		390.00
Flag pole		25.00
Hardware		505.00
Drains from second floor		68.00
Painting and varnishing 250 square yards, $3		750.00
Total for school building		37,130.32
Toilet building:		
Excavation, 130 cubic yards, at $1		130.00
Foundation, 43 cubic yards masonry, at $14		602.00
Concrete floors, 61 square yards cement flooring, at $2		122.00
Ironwork:		
1,204 pounds I-beams and channels, at $0.04	48.16	
230 pounds W. I. plates and angles, at $0.06	13.80	
520 pounds C. I. frames and covers, at $0.05	26.00	
		87.96

Digitized by Google

Toilet building—Continued.		
Lathing and plastering:		
246 square yards expanded metal, at $0.35	$86.10	
246 square yards plastering, at $0.60	147.60	
106 linear feet cement molding, at $0.60	63.60	
		$297.30
Plastering of vault, 230 square yards, at $0.40		92.00
Studding, 1,107 square feet, at $0.03½		38.75
Roof, 8 squares, at $24		192.00
Windows and doors:		
54 square feet window openings, at $0.75	40.50	
65 square feet door panel, at $0.60	39.00	
		79.50
Interior finish:		
208 square feet W. C. partitions, at $0.20	41.60	
101 square feet W. C. doors, at $0.75	75.75	
11 W. C. seats, at $5	55.00	
		172.35
168 square feet wire mesh, at $0.20		33.60
Hardware:		
4 doors, at $3	12.00	
9 doors, at $2	18.00	
168 square feet zinc, at $0.20	33.60	
		63.60
Plumbing, 1 10-inch enamel iron trough urinal		95.00
Painting, 19 squares, at $3		57.00
Total for toilet room building		2,063.06
Pavement, 71 square yards for walks from main building, at $1.60		113.60
Shed over walk from main building:		
52 posts at $1	52.00	
320 linear feet, 4 by 4 plates per B. M., at $45	19.21	
96 brackets, at $0.50	48.00	
12 squares roofing, at $24	288.00	
46 squares painting, at $2	92.00	
		499.21
Total for shed and walk to toilet room building		612.81
Total for toilet room building		2,063.06
Total for school building		37,130.32
Total for all work		39,806.19
5 per cent for incidental expenses and contingency		1,990.31
		41,796.50
20 per cent for contractor's profit		8,359.30
Grand total		50,155.80

Reconstructing residence at hospital No. 1: Estimates for reconstructing residence recently destroyed by fire, $1,740.75; project approved in civil file D. of C. No. 368, December 27, 1900; O. C. E. file D. of C. No. 712.

On November 21, a communication addressed to the division commander, from Dr. E. Diago, director of municipal hospital No. 1, containing a request that a sufficient amount be allotted to reconstruct a frame residence known as Pavilion C at hospital No. 1, which was recently damaged by fire, was referred to this department for estimate of cost of work required. Examinations revealed a one-story frame building, containing eight rooms. The roof, which was of tile, had been totally destroyed. Most of the interior woodwork and all of the plastered walls were damaged to such an extent that the remodeling of the interior of the building was deemed necessary. Windows, doors, and some of the siding of the building required repairing. An estimate amounting to $1,740.75 was prepared, and forwarded on December 18; this estimate provided for restoring the building completely, and was approved by the military governor on December 27. Work was immediately begun and will be completed on February 1, 1901.

Estimate:		
7,000 feet B. M. lumber in place, at $60		$420.00
800 square yards plastering, at $0.40		320.00
35 square Marseilles tile, at $9		315.00
200 Cuban tile, at $0.15		30.00
220 square feet window area, at $0.75		165.00
15 doors and frames complete, at $13		195.00
25 squares painting, at $2		50.00
50 squares whitewashing, at $0.75		37.50
Hardware		50.00
		1,582.50
10 per cent for incidentals		158.25
Total		1,740.75

Digitized by Google

MAESTRANZA BUILDING, IMPROVEMENTS TO ENTRANCE.

Estimate and drawings were prepared for the improvement of the entrance to the Maestranza building at the foot of San Ignacio street. The entrance hall was found to be an irregular-shaped room about 15 feet by 17 feet in size. Part of this hall was floored over, forming a room in the second floor, and leaving a sufficiently large room to admit the stairway. The floor was of old stone flagging, very irregular, and the walls were in need of decoration. The drawings provided for removing the second floor, thus extending the hall to the second floor ceiling. A new, neatly paneled Spanish cedar staircase and wainscot was to be constructed. Openings were to be bricked up. A paneled Spanish cedar ceiling built, floors to be laid mosaic tile, walls patched and decorated, and stained-glass transom windows installed. One of the rooms in the second story was to be fitted up as a kitchen. No action has been taken on this project.

Estimate:

Stairway—	
31 risers, at $15	$465.00
91 square feet iron grills, at $1.75	159.25
Second floor landing—	
Iron beams, etc	65.00
Expanded metal, concrete, and tile, 90 square feet in place, at $0.50	45.00
300 square feet of paneling, at $0.75	225.00
250 square feet new doors and windows, at $0.75	187.50
575 square feet panel work, at $0.75	431.25
65 linear feet cornice, at $0.75	48.75
65 linear feet cornice, at $0.30	19.50
100 linear feet moulding, at $0.15	5.00
70 square feet trim, at $1	70.00
30 square feet leaded glass, at $3	90.00
Decorating 235 square yards wall surface, at $0.50	117.50
Installing one sink complete	60.00
Cutting and patching walls	100.00
Cartage	50.00
	2,148.75
10 per cent for unforeseen contingencies	214.88
Total	$2,363.63

IMMIGRANT DETENTION STATION NEAR CABANA.

Estimated No. 1, for moving two barrack buildings with kitchen, passage etc., from the present location at Cabana to the proposed quarantine site near San Diego battery, with the necessary toilet arrangements, laundry, sewers, ...e, etc., $16,885; project approved in civil file D. of C. No. 4782, September 25, 1900; O. C. E. file D. of C. No. 543-1.

Estimate No. 2, for equipment required for kitchen, dining room, wash room and laundry, and sleeping apartments, $11,140.25; project approved in civil file D. of C. No. 4782, October 16, 1900; O. C. E. file D. of C. No. 543-6.

Estimate No. 3, for office furniture, tools, brass checks, mules, wagons, harness, etc., $2,084; project approved in civil file D. of C. No. 4782, October 26, 1900; O. C. E. file D. of C. No. 543-11.

Estimate No. 4, for converting the east shed of the north central building of the San Diego battery into stable for six mules; for partitions to separate guard's quarters from those of male employees; for shelving and partitions; for storage of bedding in matron's quarters, and for renovating small and ancient building on hill, $450; project approved in civil file D. of C. No. 4782, October 30, 1900; O. C. E. file D. of C. No. 543-12.

Estimate No. 5, for additional plumbing to accommodate increase in number of people to be sheltered in tents, $1,200; project approved in civil file D. of C. No. 4782, November 9, 1900; O. C. E. file D. of C. No. 543-4.

In order to prevent the city of Habana from being flooded with nonimmune immigrants from Spain and Canary Islands and to deprive the yellow fever of a new material to feed upon, it was decided to provide a detention camp for such immigrants to permit arrangements to be made whereby they could be sent to the country direct where labor is in demand without tarrying in the city. The camp is located near the San Diego battery beyond the brow of the hill overlooking Triscornia wharf. The camp as it now stands consists of administration offices and guard's quarters at San Diego battery; 6 frame barrack buildings, 5 for dormitories and 1 for toilet purposes, a kitchen and a mess hall in old masonry powder magazine, guard's office in small

Digitized by Google

stone house on hill. Tents 14 by 14 were provided by the quartermaster department to accommodate any extra rush of arrivals. A wire fence incloses the premises, and an area amply sufficient for exercise permits a good view of Habana, the harbor, the sea, and contiguous beautiful scenery. The location is splendidly salubrious. A 6-inch sewer for only wash water and urine was built to discharge about 1,000 feet from the buildings, and another 4-inch line conducts kitchen wastes a safe distance away. Water was piped from Cabana water tower. An area of 5½ acres was cleared of heavy underbrush at the site of the camp. The barracks buildings were originally a part of the United States military post at Cabana, and were removed, practically intact, to new sites.

Description of buildings, their removal and reerection.—Buildings were ordinary well-built frame structures, elevated about 3 feet on posts, with corrugated iron roof. Two main barracks were 20 feet wide, 240 feet long, and 10 feet below eaves. Each contained approximately 53,000 feet B. M., weighed with iron 115 tons, and contained 48,000 cubic feet below eaves. Two kitchens were 20 by 85 by 10 and weighed 38½ tons; contained 17,000 cubic feet below eaves. Total estimated original cost of buildings, $13,650, or 10½ cents per cubic foot.

Preparation: Kitchens were moved intact. Barrack buildings were cut in two, and resulting sections (57½ tons) were moved separately. Sections were braced at each end; 3 by 6 chamfered slides were nailed securely to sills under which enormous 6 by 6 runways, properly supported by cribbing, were inserted for purpose of turning buildings in direction of destination. Posts and underbracing were then removed.

Route: Buildings were turned at right angles, transported 2,500 feet, turned again at right angles to place. Ground traversed was rocky for first 300 feet, but thereafter presented no serious difficulty. At the start the grade was sharply rising for 300 feet. then declining about 15 feet in 90 feet, then practically level for 800 feet, the remaining distance, 500 feet, being a rise at about a 6 per cent gradient.

Method: Two gangs were employed moving two sections simultaneously. "Dead men" were placed about 200 feet apart and connected by 1¼-inch diameter rope and triple 12-inch blocks to buildings and to motive power, which was first mules but afterwards oxen, the latter being steadier and more powerful. The chamfered sills referred to traveled in well-soaped concaved runways 6 by 8 by 3 feet placed 6 feet part. No rollers were used. Runways were cribbed up where necessary. Much trouble was experienced at first by "dead men" pulling up. Each gang had on an average of about 23 men, placed as follows: Two carpenters and 2 laborers putting in "dead men" ahead of building; 2 men attending the ropes; 1 man with the ox whips; 1 man keeping the saddles and runners under building well soaped; 4 men [illegible] saddles and adjusting in line before moving building, and cribbing were necessary about 60 feet ahead of building; then, as building moved along, 3 men with cart and mule on each side brought up saddles from the rear, and 2 men on each front corner of building placed saddles and held them firmly with crowbar until chamfered slides had moved on saddle far enough to keep it from sliding or tilting. Noses of slides were kept well soaped so as to slide on saddles easily; 1 man on each side attended to any saddles that loosened and needed cribbing. On the down grade 6 oxen, on the level 8 oxen, and on the rising ground as high as 12 oxen were used to advantage, it being so arranged that one section was moving uphill while other section was on a level. The buildings were not connected again, but were spaced apart to permit the isolation of toilet room and the segregation of classes of immigrants.

Summary of cost.

	Per ton.		Per 1,000 cubic feet.		Total cost.
	For total district.	For 100 feet.	For total district.	For 100 feet.	
Preparation of buildings for moving	$1.05	$0.04	$2.47	$6.10	$320.89
Preparation for moving	.91	.04	2.15	.09	279.65
Apparatus	1.21	.05	2.94	.12	382.43
Moving	6.85	.27	16.19	.65	2,104.41
Placing on foundation	2.09	.08	4.93	.20	642.56
Repairing damage to buildings	.89	.04	2.11	.08	274.17
New work	.71	.03	1.67	.07	217.03
Total	13.75	.55	32.47	1.30	4,221.14

Digitized by Google

Total cubical contents, 130,000. Total tonnage, 307. Cost of moving alone 100 linear feet of frame building, 20 by 10, a distance of 100 feet was $1.29. Total cost of moving 100 linear feet of frame building, 20 by 50, a distance of 100 feet was $2.60.

The six buildings were placed in position and blocked up to an average height of 3½ feet above the highest point of ground, mounted upon 6 by 6 inch timber well braced; ends were closed up by siding, two additional doors inserted, and two porches or galleries were erected to connect dormitory buildings. Also a latticed picket guard fence was put around space from ground to floor timber, for the purpose of keeping the immigrants from entering underneath house, thereby lessening the accumulation of filth, rubbish, etc. These guards are removable when occasion requires. Steps were placed at all doorways. In the building converted into a toilet building partitions were erected to provide privacy, etc. Also five additional doors were inserted for access to the various departments from the outside, thus avoiding the necessity of passing through any of the other parts of the building. Screens were placed at proper height in front of the bathroom and other windows.

In the women's department, for toilet purpose, is installed all in a sanitary and workmanlike manner: Three laundry enameled wash trays, fitted with wash wringer attachments and wringer furnished; 4 overhead shower baths; 1 iron frame stand with 12 enameled wash basins provided with 2 bibb faucets; 1 hydrant bibb cock for the purpose of cleaning rooms, etc.; 7 dry closets provided with partition and swinging door for each closet. The shower bath room is 10½ by 12 feet, and provided with bell traps for drainage to sewer.

The men's department consists of 3 laundry enameled wash trays, with wash wringer attachments and wringers furnished; 14 overhead shower baths; 1 wrought-iron frame stand with 28 enameled wash basins provided with 3 bibcocks; 1 wrought-iron frame stand with 13 enameled wash basins and 2 bib faucet cocks; 1 18-foot galvanized urinal with perforated supply water pipe; 1 hydrant bibcock to be used for cleaning room; 23 dry closets. The floors of shower, basin, and laundry rooms are concreted. These rooms are well provided with partitions, clothes hooks, etc. All doors, etc., provided with new locks, hinges, etc., where needed; also, in barracks Nos. 1, 3, and 5 have put in partition and shelving for use of matron for the storing of quilts, etc.

Water supply: The water-supply line is of 2½-inch wrought-iron pipe with 1½-inch brahches at camp, provided with necessary valves, two lead extension joints, and a lever pump near toilet building to be used whenever water supply is low in Cabana water tank. The line of pipe is in the most direct line and at two places close to the hydraulic grade line, requiring that the water tank be kept full of water, which will be necessary at any rate to obtain a working pressure.

Sewers: A line of 6-inch vitrified sewer-pipe joints laid with Portland cement and mortar running from toilet barrack building to a proposed location for a septic tank, a distance of 974 feet. The excavation of the sewer ditch was through a very hard, rocky ground, which necessitated dynamite blasting. The sewer line is constructed to obtain the required gradient with the least possible excavation. The septic tank was not considered necessary for the present, but may be constructed at any future time with a filter bed for complete sewage purification.

Dining room and kitchen: A dining room and kitchen department is fitted up in the old magazine building for the accommodation of the immigrants. Seven large openings for windows and 3 for doors were cut through the 3-foot walls; also 2 additional gate openings and one-half window opening for kitchen were cut through heavy curtain walls inclosing magazine building. The windows in dining room are fitted with glazed sash, etc. The old floor was torn up, which was of native wood, square joist floor timber, and hardwood flooring. This native wood included mahogany, júcaro, cedar, jocuma, acana, and sabaen, and is stored in the Maestranza building. A new yellow-pine floor of tongued and grooved lumber (6 by 6 inch yellow-pine joists) was laid. The size of dining room is 33½ by 75 feet. All woodwork in this building has been painted, the walls of the dining room painted with alabastine. The outside walls of dining room have been whitewashed, also inner walls of the curtain wall. A corrugated roof was built reaching from building walls to curtain walls, covering approximately 1,320 square feet. This is to be used as a kitchen. Four enameled kitchen sinks, provided with hydrant cocks, have been placed in kitchen department.

Storehouse 9 by 14 feet has been built in corner of yard, covered with corrugated iron, to be used as a storage for the cooking department. Twenty white-pine tables 2 feet 9 inches wide by 2 feet 9 inches high by 14 feet long, each table provided with two 14-inch benches for the accommodation of immigrants, also two kitchen tables for the cooking department, each 6 by 3 by 3 feet, have been provided in

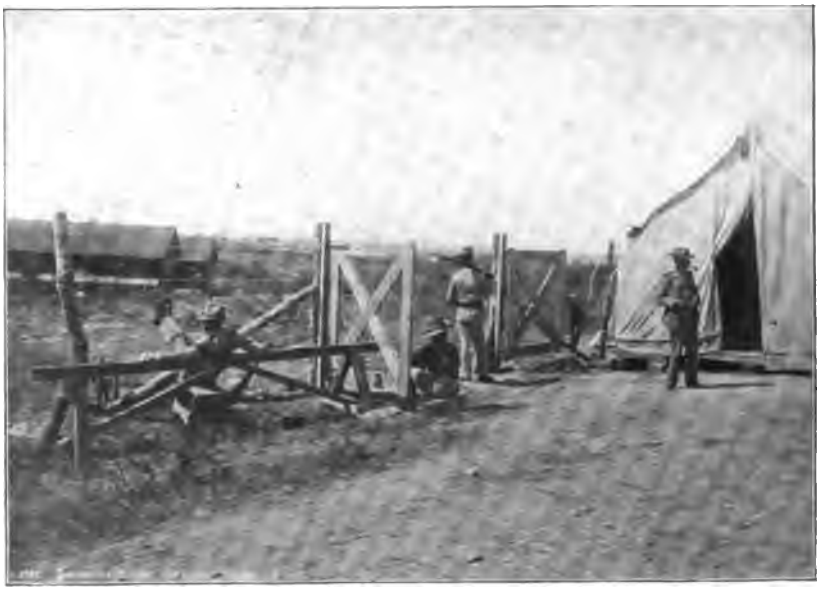
Digitized by Google

MOVING BUILDING TO QUARANTINE STATION. BLOCKED UP TO MOVE.

MOVING BUILDING TO QUARANTINE STATION.

Digitized by Google

Digitized by Google



QUARANTINE STATION, NOVEMBER, 1900.

Digitized by Google

Digitized by Google

CABAÑA QUARANTINE CAMP STABLE.

Digitized by Google

Digitized by Google

kitchen department; also six old army ranges in good condition, which were obtained from the quartermaster's department; new stovepipe and a complete set of new kitchen utensils for cooking. A 4-inch vitrified sewer was laid from the kitchen to a distance of 400 feet, all joints cemented and provided with clean-out openings, etc. This was for kitchen waste only. Twenty lamp-posts made of 6 by 6 inch by 12 foot timbers have been placed in position by the superintendent of the station.

Four hundred iron bedsteads with "double decks" were ordered direct by the medical department from New York and are in use.

A complete number of oil lamps, large size, have been placed in barrack; also the outside lamps on grounds.

The quarantine station is inclosed by a well-built 6-strand barb-wire fence, well secured by strong staples and tightly stretched. The fence posts are on an average 5 inches diameter and of hard native wood; tops sawed off square; posts have been well braced by additional ones placed slanting where needed, especially at the corners and gate openings; post holes were on an average 2 feet deep and posts well rammed.

QUARTERS OF EMPLOYEES AND GUARDS AT SAN DIEGO BATTERY.

In this department a sewer was put in; 4-inch cast-iron soil pipe 96 feet long, also vent pipe 15 feet additional to roof; 1 wrought-iron frame, 3 basins and faucet; 1 wrought-iron frame, 2 basins and faucet; 2 cement floors, each 10 by 12; 2 yellow-pine tongued and grooved partitions. The buildings of the quarantine have protection from fire by separate pipe connection from the water supply, to which are attached two lines of 1½-inch linen hose and nozzles, with a total length of 600 feet, which are run upon reels, easily attached, and can be brought into play upon the conflagration, should one occur; also, placed in each of the sleeping quarters are two 50-gallon water barrels, each provided with galvanized buckets, so that with care and promptness no serious fire need occur.

A stable was improvised in the shed at the north side of central building for the shelter of mules used in hauling for the camp. Stalls were built for six mules, each stall provided with feed box and hay rack, with a door to each stall.

The stable was built for the animals of the rural guards at the San Diego battery, but when the framing was about erected was removed to a location down the hill toward the Government post, in order not to mar the appearance of the ancient battery. The stable was 30 by 62, arranged for the accommodation of 20 head of stock; open entrance into stall for easy exit in case of fire. Stalls are 5 feet wide by 10 feet long, each provided with Mott patent iron feed box and a wooden hay box. The center aisle of the stable is 10 feet wide for the storing of buggies, wagons, etc. This aisle is separated from the stalls by a closed partition running full length, but of the height of 6 feet, thus allowing stable to be well aired and light. The stalls are leveled with broken stones covered with good depth of soil, with ample slope to to give first-class drainage. In the front end of stable building two rooms have been built 10 by 12 feet, one for the purpose of sleeping and waiting quarters for the attendants the other as a harness and supply room, provided with hooks and shelves.

The stable is strongly built; uprights, tie timbers all of 6 by 6 inch yellow pine; braces 4 by 4 inches running full length. The roof is pitched with rafters of 2 by 4 inch timber, sheeting yellow pine, the whole covered with John's Abestos Brooks patent roofing paper; same given two coats of paint. Both ends of the building and sides of rooms on outside, together with doors and windows, have been painted with two coats of oil paint. The inside of rooms and sides of the long partition have been painted with two coats of alabastine, making a neat and clean appearing stable. The front and sides of rooms are seven-eighth inch dressed siding, the back ends of yellow-pine tongued and grooved flooring. Extra handling of material in transportation across the harbor and up the steep hills, coupled with the necessary haste in which the work was done, added materially to the costs and difficulties. F. W. Piel, foreman in charge.

Digitized by Google

Statement of cost of the several classes of work.

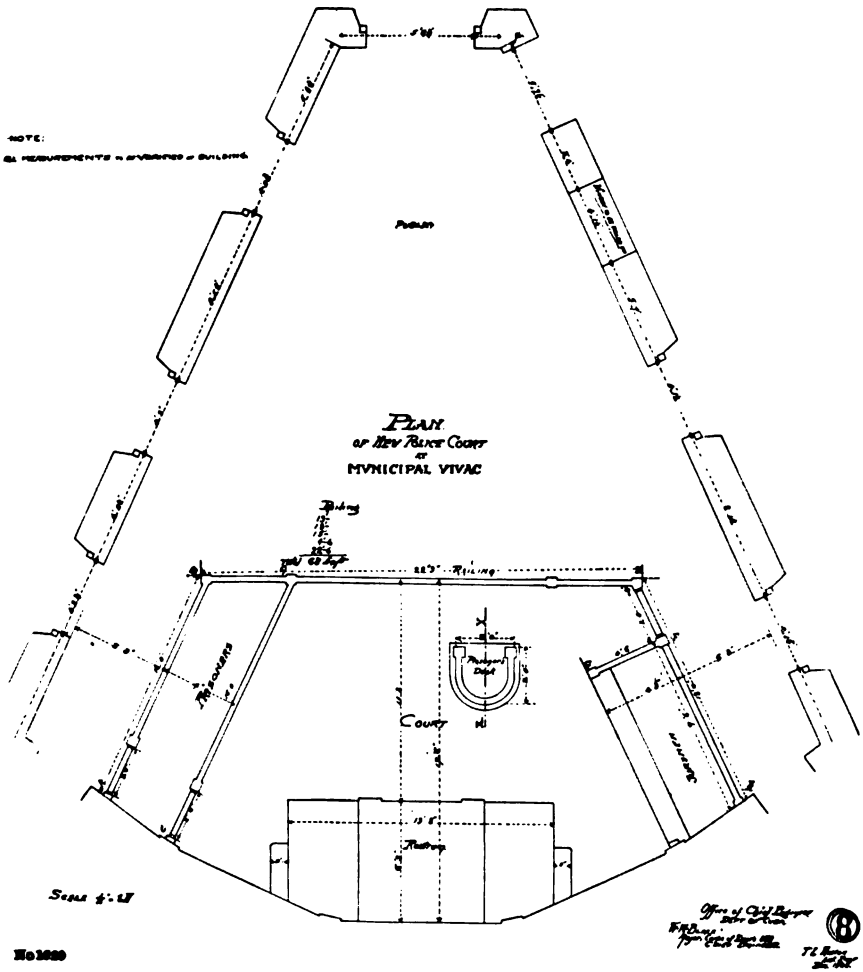
	Material.	Labor.	Oxen hire.	Total.
Moving houses	$801.60	$2,696.50	$723.04	$4,221.14
Paling under houses	134.00	205.25	.....	339.25
Plumbing:				
Bath barracks	709.02	574.13	.....	.....
Kitchen plumbing	60.22	27.25	.....	.....
Employees and guardroom	55.91	54.51	.....	1,481.04
Barrack sewer: 6-inch vitrified pipe	193.79	246.92	.....	440.71
Dining-room sewer:				
4-inch vitrified pipe	55.33	96.97	.....	151.30
Water-supply pipe	884.02	140.69	.....	1,024.71
Clearing ground	.....	213.48	.....	213.48
Barb-wire fence	302.50	387.81	.....	690.31
Fence posts on hand	148.00	.....	.....	148.00
6-stall stable	42.46	36.62	.....	79.08
Cement work	65.00	124.72	.....	189.72
Fire protection	248.73	4.69	.....	253.42
Guardhouse repairs	10.25	27.96	.....	38.21
Disinfecting	20.96	1.00	.....	21.96
Tool house	42.32	15.00	.....	57.32
Kitchen building	123.96	83.15	.....	207.11
Kitchen, miscellaneous:				
Painting	35.55	70.71	.....	106.26
Alabastine work	13.50	14.00	.....	27.50
Whitewashing	1.25	25.62	.....	26.87
Dining-room building:				
Carpenter work	243.78	484.00	.....	727.78
Masonry work	30.15	374.63	.....	404.78
Labor cleaning	.....	89.95	.....	89.95
Dining-room tables	112.44	55.56	.....	168.00
Dining-room benches	40.35	62.69	.....	103.04
Kitchen tables	3.20	5.00	.....	8.20
Storeroom fixtures: Tables, platform, and boxes	6.41	14.00	.....	20.41
Guard and employees' building:				
Masonry	2.80	37.00	.....	39.80
Carpenter	3.47	8.13	.....	11.60
Whitewashing	1.00	3.50	.....	4.50
Dormer window (office)	21.96	24.00	.....	45.96
Office furniture	14.12	8.31	.....	22.43
4 tables	2.24	4.75	.....	6.99
Drawbridge repair	6.66	5.00	.....	11.66
Official monthly roll	.....	1,545.44	.....	1,545.44
Miscellaneous work	.....	46.69	.....	46.69
Lamp, lantern, and posts	152.19	49.60	.....	201.79
Returning tools	.....	14.92	.....	14.92
Material delivered to other buildings	361.85	.....	.....	361.85
Stationery, reimbursements, general repairs, hauling, etc	528.06	.....	.....	528.06
Barrack screens	2.60	19.51	.....	22.11
Shelving	36.66	48.63	.....	82.59
Partition	104.07	236.25	.....	340.32
Dry closets	21.36	62.24	.....	83.60
Lime and oil	36.00	.....	.....	36.00
Repairs to tools	.....	38.66	.....	38.66
Night watchman	.....	172.69	.....	172.69
Boatman	.....	207.62	.....	207.62
Outfit and equipment for 600 people	3,359.36	.....	.....	3,359.36
New stable	628.50	504.68	.....	1,133.18
Total	9,667.59	9,212.95	723.04	19,603.58

Municipal Vivac: Estimate No. 1, for the construction of an addition to be used as a court room, $2,803.82; project approved in civil file D. of C. No. 1236, August 13, 1900, O. C. E. file D. of C. No. 473. Estimate No. 2, for making the structure called for in estimate No. 1, more permanent and ornamental in character, $2,700; project approved in civil file D. of C. No. 1236, October 22, 1900, O. C. E. file C. of H. No. 5650-36.

At the time of American occupation, the building known as the Municipal Vivac, and which had formerly been occupied as a barracks by the civil guard of Habana, was being used as a prison for persons arrested and awaiting a preliminary examination, or according to the Spanish law, a trial by correctional court.

During the year 1899 the building was renovated, remodeled, and converted into a detention prison, one room being roughly fitted up as a correctional court room. The capacity of the building for the purpose above stated has been taxed to the utmost from the first, and the necessity of providing a court room of sufficient size to accommodate the large number of prisoners who daily appear for trial became more pressing from day to day.

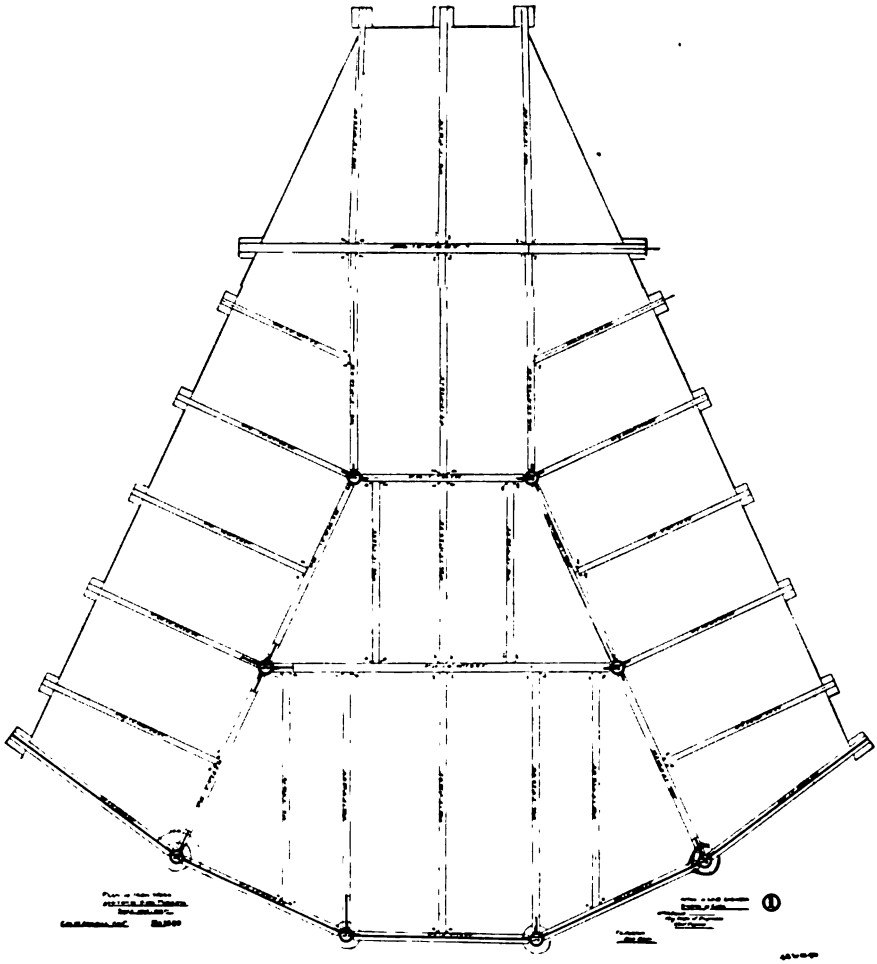
Digitized by Google



PLAN OF NEW POLICE COURT, MUNICIPAL VIVAC.

Digitized by Google

Digitized by Google



PLAN OF IRONWORK, ADDITION TO MUNICIPAL VIVAC.

Digitized by Google

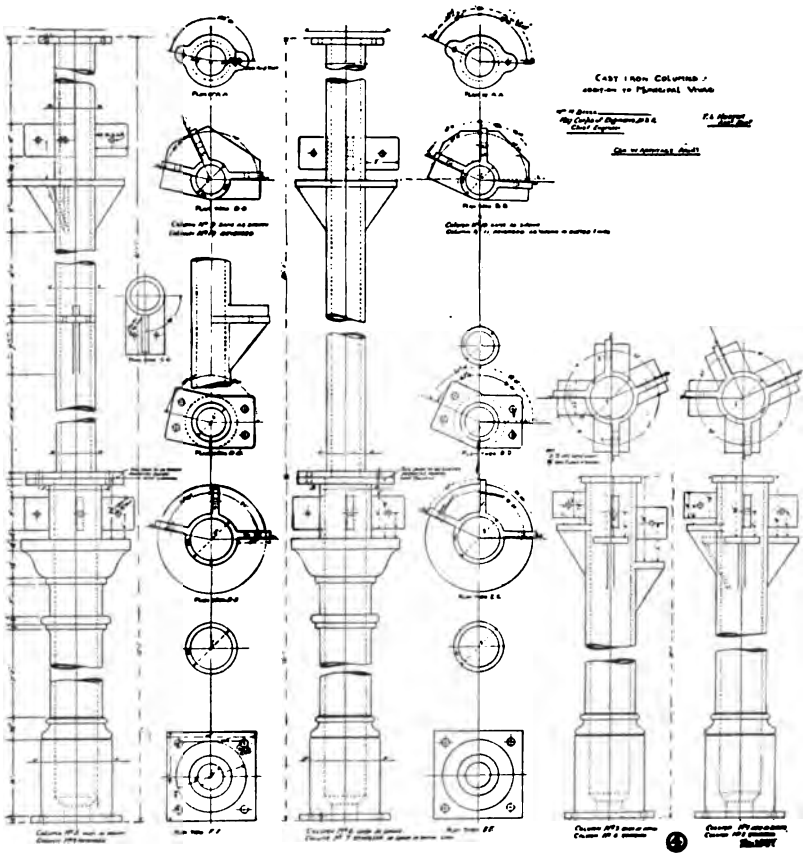
Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

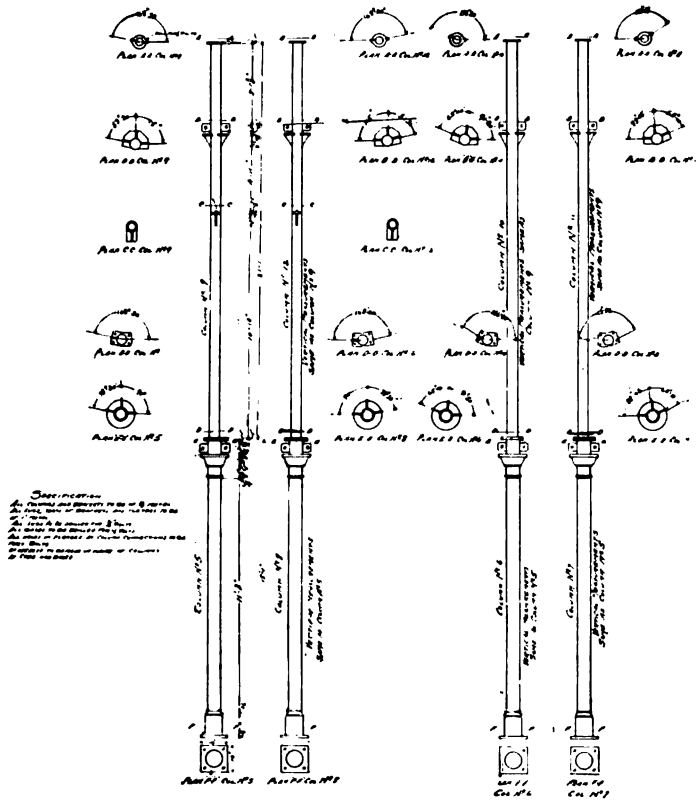
Digitized by Google



CAST-IRON COLUMNS, ADDITION TO MUNICIPAL VIVAC.

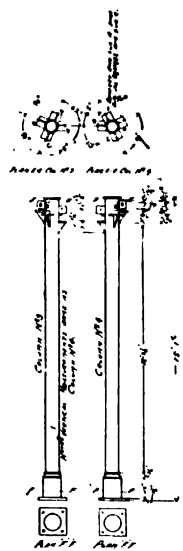
Digitized by Google

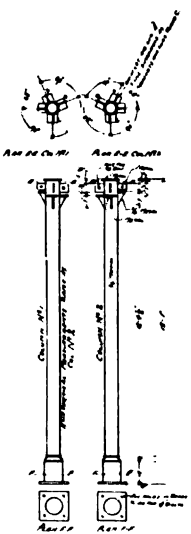
Digitized by Google



Scale Drawings of Cast Iron Columns
For Addition to
Municipal Vivac

Office of Chief Engr
Div of Cuba
W.M. Black Maj Corps of Engineers USA
Chief Engr





No 1609

Digitized by Google

Digitized by Google

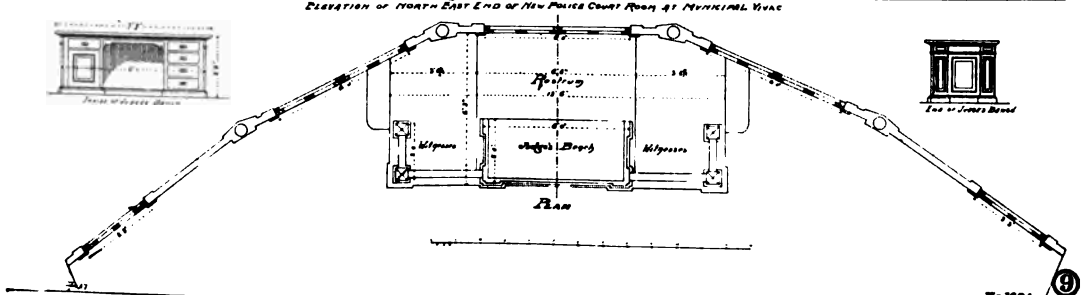
ROSTRUM & WINDOWS.

in New Police Court Room

at

MUNICIPAL VIVAC

ELEVATION OF NORTH EAST END OF NEW POLICE COURT ROOM AT MUNICIPAL VIVAC

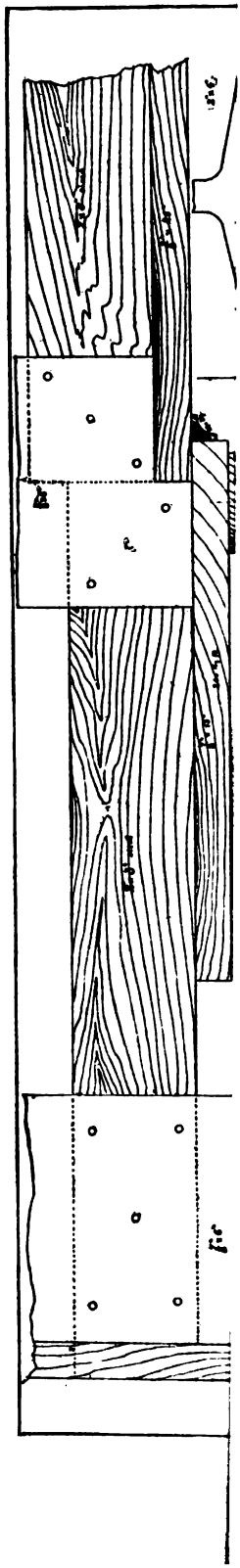


PLAN

No 1884

Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google

VIVAC, JANUARY, 1901.

Digitized by Google

Digitized by Google

At the request of Major Caziarc, supervisor of police, an estimate amounting to $2,803.82 was prepared on August 10, 1900. The estimate provided for the erection of a triangular shaped addition to the Vivac, with a floor space of about 1,385 square feet. New cast-iron columns, and existing stone columns were to be utilized for supporting the new structure, the wall of which was to inclose the court room on one side of the triangle. The walls of the old building, forming the other two sides of the triangle, were to be utilized as inclosing walls for the court room, the floor of which was to be on a level with the second floor of the old building. The addition was to be constructed of expanded metal and cement plaster laid on wood studding, the floor was to be of tile, the roof of tin, and the ceiling of yellow pine with cornice and rails added to secure a pleasing effect.

Upon notice of approval of the project by the military governor, complete plans were at once prepared, bill of materials made out, and was about to be ordered when new developments arose.

At that time, completion by this department at the dragones barracks of a new police and correctional court, together with other work, attracted the attention of the persons interested in the vivac court arrangements. The new and tasty appearance of the Dragones court room and its commodious facilities developed a desire to have at the vivac, the most important police court of Habana, a room equal at least to that of the less important court room of the second district, and on October 19, 1900, this Department submitted a new estimate amounting to $2,700 for additional funds in order to carry out the new demands.

This additional estimate was approved, making a total of $5,503.82. The first plans were disregarded and an entirely new set of plans prepared. These plans provided for an addition to be constructed of cement and iron; wood to be used only for interior finish.

The addition will be the same in size, shape, and location as described for first project, but will be supported on eight 8-inch cast-iron columns. The four outer columns will be extended up, forming supports for part of the second tier of beams which form part of the roof construction. The first tier of beams forming part of floor of court-room, and the roof beams will be covered with heavy, expanded metal, over which will be laid 3½ inches of concrete and a ⅝-inch finish coat of cement mortar. The roof of the building will be finished in the same manner. The inclosing walls will be of 3-inch metal studding extending between, and being bolted to first floor and roof girders. A parapet will be formed by extending the metal studding 3 feet above the top of the beams forming outside roof girders; the tops of these studs will be bolted to a piece ¼-inch by 4-inch strap iron that will be bolted to and stiffened by the cast-iron columns that will be extended to the top of the parapet wall. The metal studding will be covered inside and outside with expanded metal, plastered two coats with cement plaster on the inside and outside. A comparatively large percentage of the funds allotted for this work will be spent on decorating the interior of the court room.

The area of the court room is 1385 square feet, of which 555 square feet are railed off to form the court proper, and 850 square feet are open to the public or used as passageways. The appearance of this court will be greatly enhanced by the opportunity offered for woodwork decoration, by eleven doors distributed on the four sides and opening into the main stair hall, the surrounding offices, and the balconies. These doors are to be handsomely paneled and finished with jambs, pilasters, and caps. Three windows will be similarly treated with hinged sashes opening on the prison yard. The ceiling will be formed on heavily molded rails and receding panels bordering a field of narrow-face, beaded wood. The monotony of this field will be broken by a beautiful hand-carved centerpiece. In one of the angles of the ceiling a skylight 4 feet square will be located, the shaft of which will be divided into panels separated by carved pilasters. The shaft will be covered with heavy, colored glass. Extending around the entire room will be a heavy, molded cornice; baseboards, chair rails, and picture molding will complete the interior decoration.

The windows and three of the doors are to be provided with transoms, in order to afford ample ventilation to the room; white muranese glass is to be used throughout, and Spanish cedar of the best quality will be used for all the decorative woodwork, including doors, windows, and ceiling, as well as the fittings and furniture of the court, which will comprise a heavy wood railing dividing the space allowed for the public use from the court, and inclosing on the right a space reserved to prisoners when tried in common, and on the left the platform provided for the jury. Access to the court will be through these gates in this railing. On the rostrum, composed of a platform 6 feet 3 inches by 14 feet and raising three steps above the floor, will be placed the judge's bench, and on each side of same, but one step lower, will be placed the stand for the witnesses, surrounded by a neatly designed wood railing. Simi-

Digitized by Google

larly surrounded is a lower platform, semicircular in shape, to be used as a prisoners' dock; this dock is to be movable and easily placed in the position most favorable to facilitate proceedings at a trial. Walls, after replastering, will be painted and decorated in oil colors, in a quiet but tasteful manner, and in a way to harmonize with the interior woodwork decoration. This work is well under way, and will be completed about February 10, 1901.

Estimate No. 1.

Patching old tile roof	$20.00
6 C. I. columns, 14 feet long, each, at $2 per foot	168.00
75 yards of tile floor, at $2	150.00
625 square feet of new flooring at $0.20	125.00
130 square yards of ceiling, lathed and plastered, at $0.80	104.00
12 squares of roof, complete, at $10	120.00
660 square feet of mullion windows, at $0.60	396.00
180 feet of Louvre slats, at $0.50	90.00
3,000 feet B. M. of heavy timbers, at $55	165.00
Painting 39 squares, at $2	78.00
Nails and hardware	30.00
Tearing down old roof, etc	75.00
Cutting holes in masonry	30.00
Cartage	60.00
54 square feet of wainscot, back of jury box at $1	54.00
Platform in jury box	35.00
50 feet railing and gates, at $5	250.00
Judge's platform, 12 by 7 feet	35.00
Witness stand	35.00
Dock	55.00
Lawyers' table, 3 by 6 feet	50.00
Lawyers' bench, 10 feet long, at $4	40.00
540 square feet of partitions, at $0.20	108.00
Breaking door opening	4.00
3 doors with trims complete, at $15	45.00
	2,322.00
5 per cent for incidentals	116.10
	2,438.10
15 per cent for contractor's profit	365.72
Total	2,803.82

Estimate No. 2.

OCTOBER 19, 1900.

SIR: I have the honor to inform you of the completion of plans, bill of materials, etc., for the erection of an addition to the Municipal Vivac, to be used as a court room, authorized in civil file D. of C. file No. 1236 and O. C. E., D. of C. 473, dated August 16, 1900, and that this department is ready to execute the work as projected. Before commencing, however, it is considered advisable to call your attention to the following facts:

The addition as planned is of a metal lath and cement plaster over 2 by 6 studding, forming a wall supported on iron columns and beams. The roof is a flat tin roof with an air space between ceiling and roof. The interior is of yellow pine, finished natural. For reasons of economy this type of construction has been used to a considerable extent heretofore in public improvements in Habana. Recently, however, it appears that the department has seen fit to construct buildings of a more permanent nature, which is exemplified in the case of the Santiago school, and in the work now nearing completion at the Dragones barracks, at which place a room is being fitted up to be used for the same purpose as the new room at the Vivac. The said room has been finished in Spanish cedar, with paneled ceiling and with railing, rostrum, furniture, etc., of a superior type. If this is the kind of finish expected at the Vivac court room, there is a disappointment in store, as the latter room will suffer in comparison with the court room at the Dragones barracks. If it is considered advisable to make the work at the Vivac of a permanent character, the structure can be built of iron framework, with expanded metal and concrete floor, and roof with expanded metal and cement plaster walls on iron studding. The interior finish can be of a type similar to the kind used at the Dragones barracks court room, and the interior can be made very attractive.

The additional work would entail an increased cost, over the amount now authorized to be expended ($2,803.82), of $2,700, as follows: $1,800 for ironwork and concrete construction, and $900 for a high grade interior finish of Spanish cedar. Both estimates have been approved and the work is well under way.

On December 21, 1900, a communication to the chief engineer from Maj. Louis V. Caziarc, captain, Second United States Artillery, supervisor of police, was referred to

Digitized by Google

this office requesting an estimate for certain additional improvements to Vivac, after the completion of the present project. The additional improvements will embrace a brick driveway in and out of the courtyard and two entrances, inclosing space under the new court room, constructing two dark cells for refractory prisoners in present stable room; placing ventilating windows in the nonimmune prison room; additional electric light; repairs to roof, walls, etc., and painting and whitewashing the entire building inside and outside. An estimate for this work is being prepared and will be submitted shortly.

These facts are respectfully submitted for your consideration. I await further instructions.

Very respectfully, your obedient servant,

GEO. W. ARMITAGE,
Assistant Engineer.

Lieut. W. J. BARDEN,
Corps of Engineers, U. S. A.,
Chief Engineer, City of Habana.

Financial statement:

Total approved estimate of cost of work	$5,503.82
Total allotments	5,503.82
Total expenditure	1,297.92
Balance unexpended	4,205.90
Outstanding liabilities	2,167.26
Balance available December 31, 1900	2,038 64

Alex Browning, general foreman in charge.

Atares Castle: Estimate No. 1 for fittting up this fort as a prison for short-term prisoners, $22,100. Project approved in civil file D. of C., No. 1236, November 10, 1900; O. C. E. file D. of C., No. 663–1.

Atares Castle, a small bastioned stone work occuping a conical-shaped hill at the head of the harbor, southwest from the entrance to the bay, was erected between the years 1763 and 1767. The fort proper covers an area of 29,000 square feet, and is surrounded by a deep moat 24 feet wide. The interior of the fort is divided into 10 casemates, irregular in shape and sizes, the six largest ones being 20 feet in width, and varying in length from 25 to 145 feet. Two magazines 20 by 30 feet and 20 by 40 feet in size, respectively, are located on opposite sides of the building and inclosed by exterior walls 16 feet thick. Most of the casemates receive the greater part of the small quantity of air and ventilation afforded them from the interior court, which covers an area of about 2,250 square feet. This fort never fails to attract the interest of tourists and strangers. Its isolated position and ancient appearance, with no near-by modern structure to detract from the effect, renders it one of the most picturesque sights in Cuba.

Since the American occupation the fort has been used as a prison for the confinement of short-term prisoners. It was considered advisable to continue to use Atares for prison purposes, but the total lack of sanitary accommodations necessary for the proper confinement of prisoners made it necessary to prosecute improvements and additions for the proper sanitary accommodations for the necessary number of prisoners and quota of guards.

Plans for improving ventilation, providing toilet accommodations, and water supply, officers' and guards' quarters, pump house, and new steel gratings, together with the general improvement of the interior of the structure, were ordered prepared by the military governor. This order was complied with, and on November 8, 1900, the military governor approved an estimate of $22,100 for this work. The plan of arrangement covered by this estimate provided accommodations for 136 male prisoners, 71 female prisoners, 30 guards, and one officer and clerk.

Five of the casemates will be converted into prison rooms for men and two for women. Each prison room will be equipped with a separate toilet room, which, however, will be completely shut off from the prison rooms and be ventilated separately.

The toilet rooms for men will contain water-closets and urinals, one of each for every 15 prisoners, and wash basins, one for every 10 prisoners. The toilet rooms for female prisoners will be provided with showers and bath tubs supplied with hot and cold water. All water-closet bowls used throughout the building will be heavy earthenware bowls with earthenware immovable seats.

Digitized by Google

The plumbing pipes and cisterns will be concealed behind a partition set out from the masonry wall 16 inches, and forming back of water-closet. A prisoners' shower room containing ten showers will be provided and located at a convenient point.

In order to furnish employment for female prisoners, a small laundry building, size 18 by 20 feet, will be erected in the moat surrounding the fort. Four enameled-iron laundry tubs and a hot-water boiler and heater will be installed here.

Three slop sinks will be installed at convenient points throughout the fort, and will be provided with threaded hose bibs to which hose can be attached when scrubbing out rooms.

Two main branch drains extend to the several batteries of fixtures in the several prison rooms, and are trapped and vented before entering the 8-inch sewer, which is extended through wall and embankment surrounding moat to a point on the hillside 200 feet below, where it will empty into a ditch that leads to bay. It is the intention to extend and connect this sewer to the new sewer system when the same has been constructed.

Vento water will be supplied to the fort, taken from a 4-inch main in Cristina street, from which point a 2-inch main will be extended to a 300-gallon pressure tank, to be located at the foot of the hill about 400 feet from the fort. A 10-inch Rider hot-air engine will be provided to pump water to a 3,000-gallon tank, to be located on top of fort at an elevation of 100 feet above pressure tank.

From Chistina street a 2-inch gas main is to be extended to the fort and branched to all points in the fort that require lighting. Plain but substantial fixtures will be used throughout.

In order to increase ventilation, openings will be cut in the roof and side walls of the fort. Those in the roof will be circular, 6 feet in diameter, and cut through 7 feet of masonry, the average thickness of the roof at the dome of the vaulted ceilings in the casemates. The openings will be covered with glass skylights with sides left open for ventilation and grated for security. The openings in the side walls will be few in number and will be made of a size and located at points where they are least liable to mar the exterior appearance of the fort.

About 400 square yards of cement flooring will be laid in patching and renewing old floors. Throughout the structure a new system of steel gratings will be installed. Four steel cells for unruly male prisoners and three for female prisoners of the same type will be erected in small rooms adjoining the male and female quarters, making a total of 3,000 square feet. The general arrangement is such that a complete separation of the sexes can be secured and the sexes divided into classes.

During the month of December, 1900, the project as originally planned was modified in order to preserve the antique and picturesque appearance of the fort. It was decided to erect the administration building and guards' quarters at the foot of the hill about 400 feet from the castle, instead of on the roof of the structure, the site first proposed. It was also intended to erect the prisoners' houses upon the roof, but the modified arrangement places them in one of the magazines below. With this latest arrangement, the fort will retain its original character in all respects when viewed from a distance.

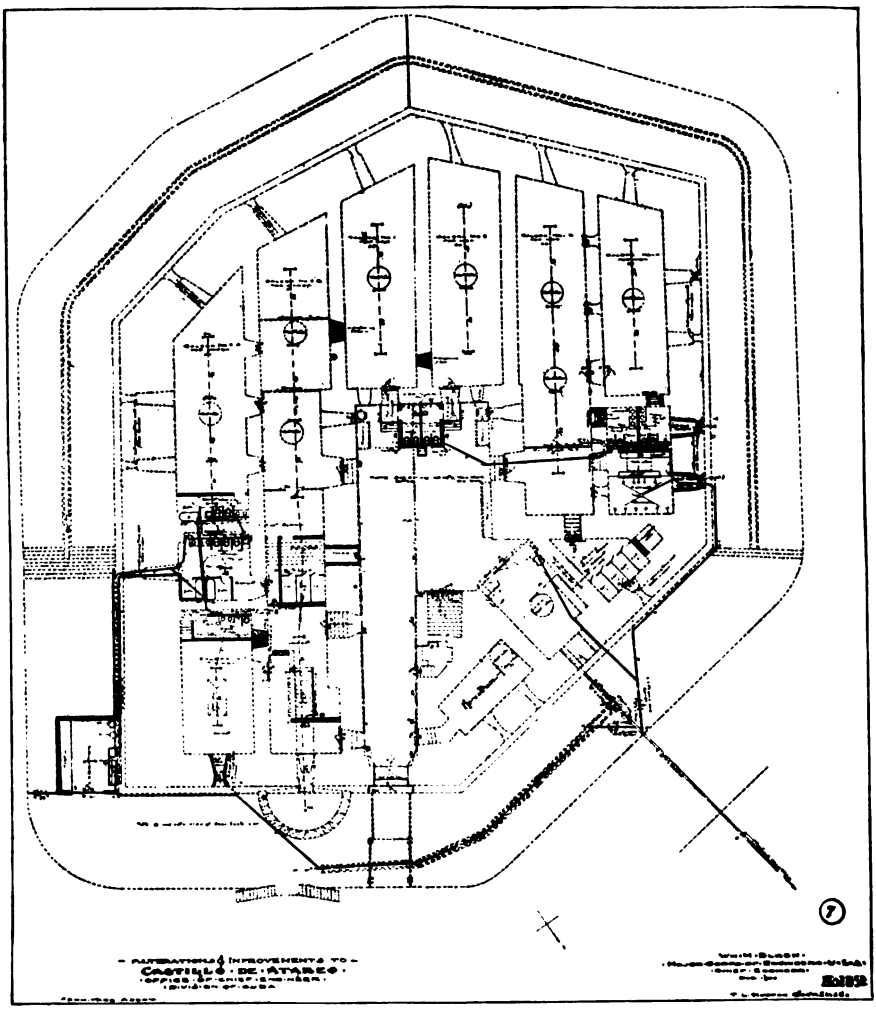
The administration building will be a one-story structure with Marseilles tile roof; walls of building to be formed of expanded metal and cement plaster; doors and windows to be trimmed; yellow-pine ceiling; cement floors; interior finish of hard oil.

The building contains the office, private room, and toilet room of the lieutenant in charge, a dormitory for the accommodation of 30 guards, and toilet and bath accommodations for guard. The main portion of the building covers an area of 19 by 77 feet; two wings, size 16 by 16 feet, project front of main portion at each end, forming three sides of a square, around which a covered veranda 6 feet wide will be erected. A 4-inch vitrified sewer line will be extended from plumbing fixtures in building, trapped and vented, and laid around the base of the hill, a distance of 600 feet, to a point where it can be turned into creek heading to bay, until such a time as it can be connected with the new sewerage system.

The two systems of plumbing and drainage, i. e., that in the fort and that in the administration building, will conform in all respects with rules governing recent practice in sanitary plumbing as regards method of installation.

In the rear of the administration building, a pump house, size 12 by 12 feet, of same construction as administration in all respects, will be erected. In this building will be located the 10-inch Rider engine and pressure tank before mentioned. On January 7, 1901, the work above outlined will be commenced under the supervision of Mr. Fred W. Piel, general foreman.

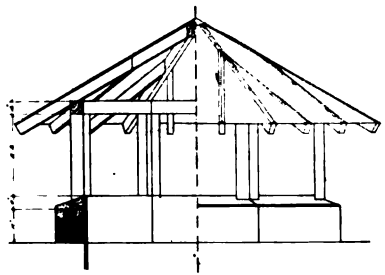
Digitized by Google

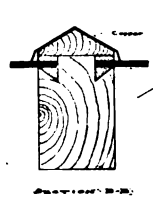


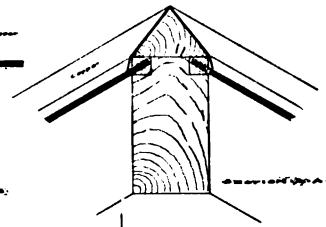
CASTILLO DE ATARES.

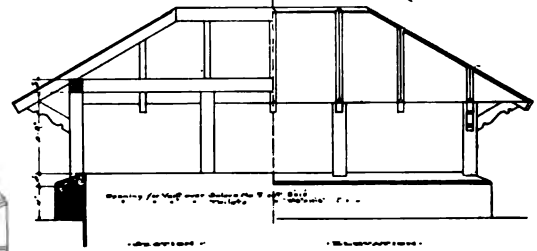
Digitized by Google

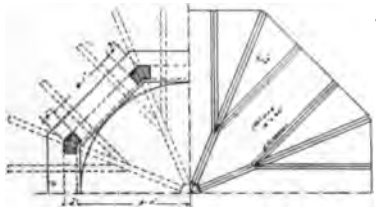
Digitized by Google

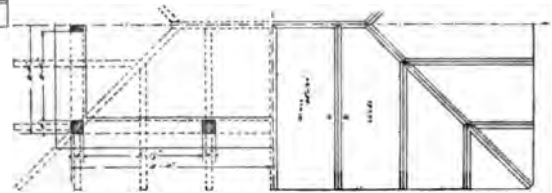






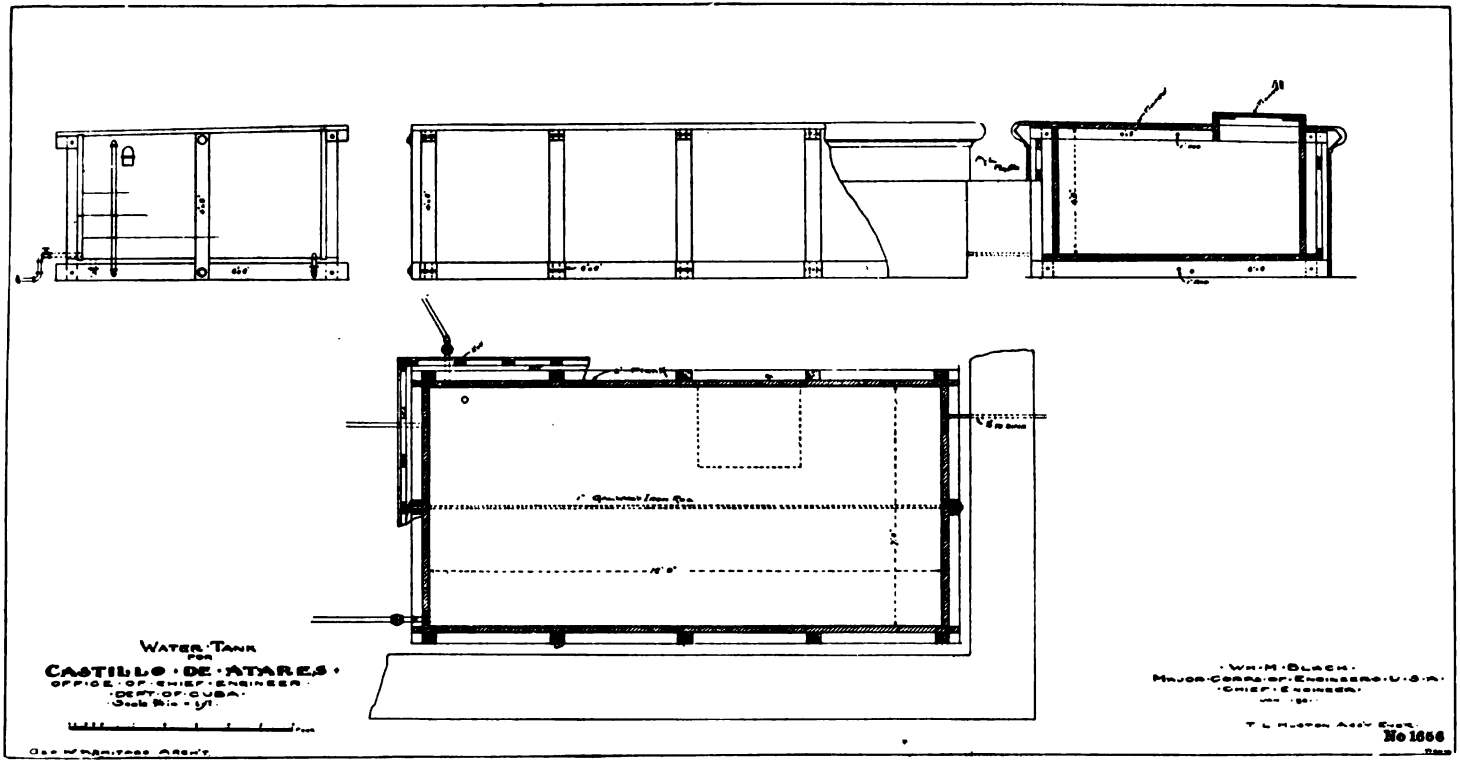






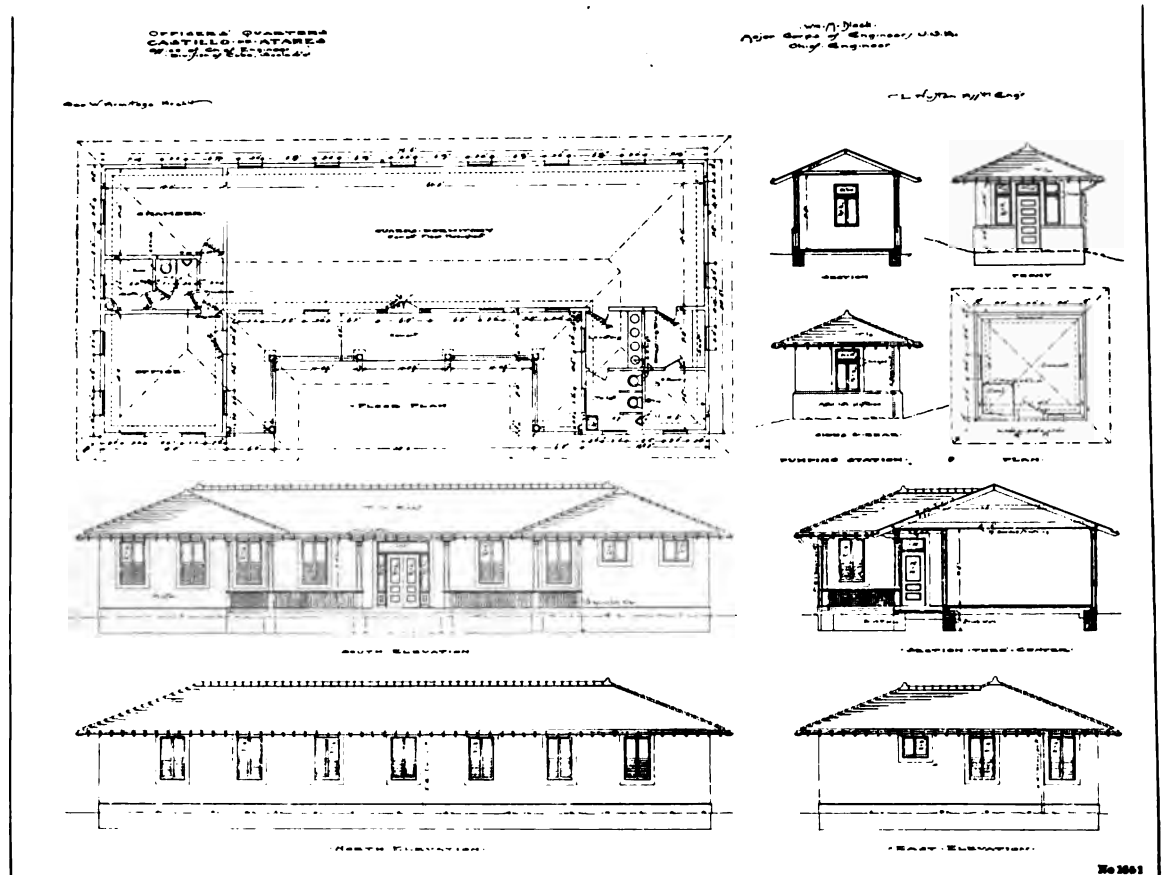
Digitized by Google

Digitized by Google



Digitized by Google

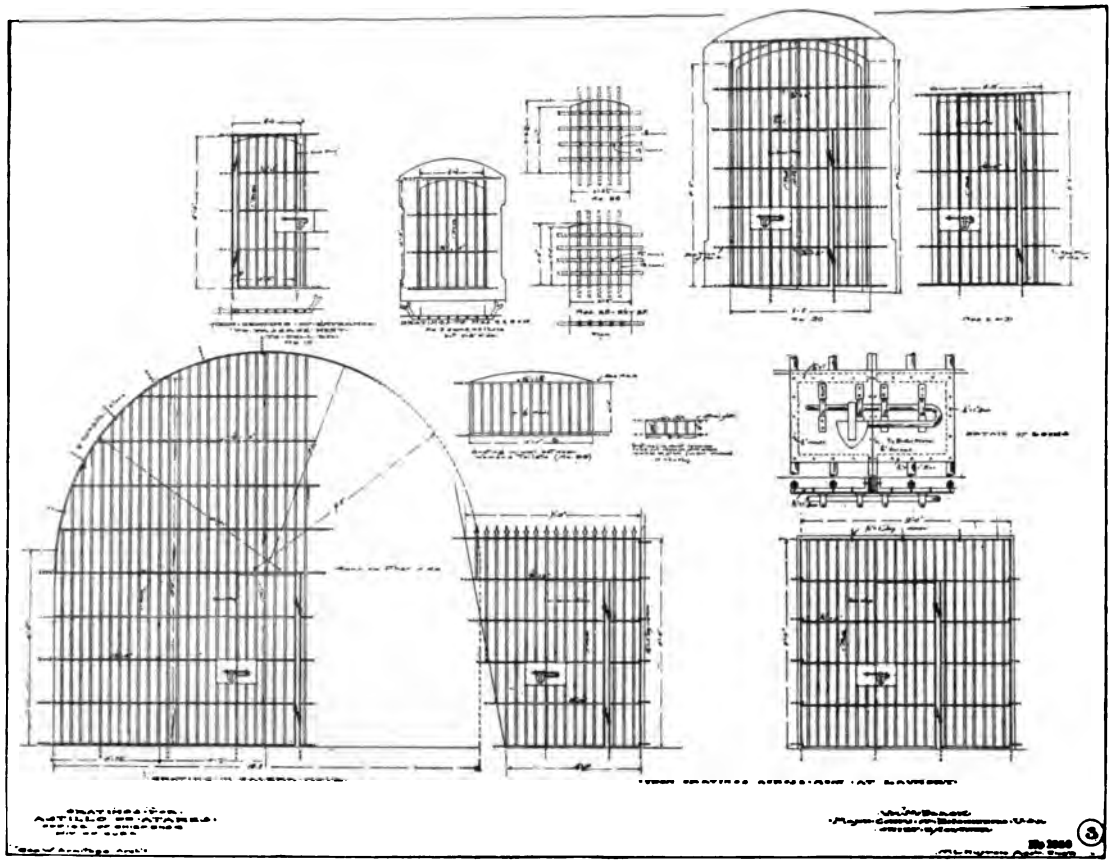
Digitized by Google



OFFICERS' QUARTERS, CASTILLO DE ATARES.

Digitized by Google

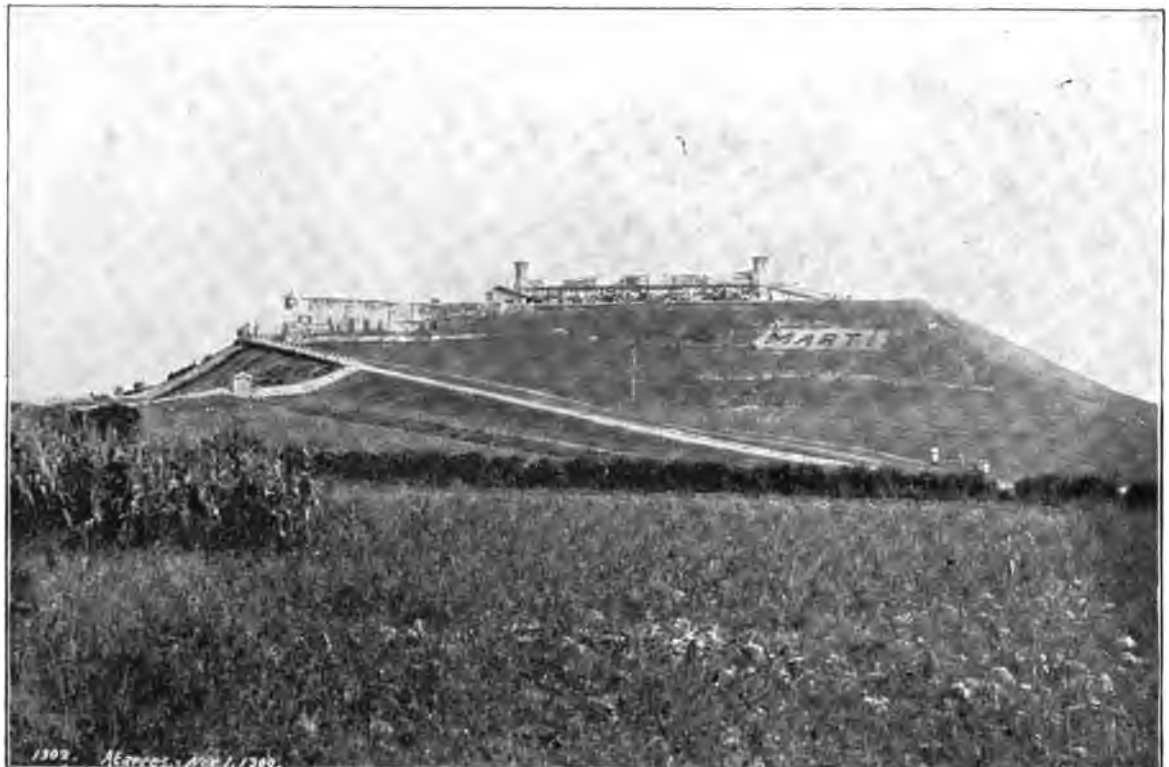
Digitized by Google



GRATINGS FOR CASTILLO DE ATARES.

Digitized by Google

Digitized by Google



ATARES CASTLE.

Digitized by Google

Digitized by Google

Estimate, Altares Castle as a prison for short-term prisoners.

Cutting and patching:		
375 cubic yards of rock excavation for improvements of ventilation, at $3	$1,125.00	
250 linear feet of rock excavation for drains, at $1	250.00	
700 cubic feet of masonry for closing openings, at $0.50	350.00	
700 square yards patching, at $0.25	175.00	
772 square yards plastering, at $0.50	386.00	
		$2,286.00
Cement floors: 500 square yards cement flooring, at $1.80		900.00
Iron guards and cells:		
1,800 square feet steel grating for doors, window openings, and ventilators, at $1.25	2,250.00	
7 iron cells, each 4 feet 6 inches by 7 feet by 7 feet 6 inches, or 698 square feet, at $1.50	1,047.00	
		3,297.00
Covers for ventilating flues:		
10 covers, at $40	400.00	
1 cover, at $50	50.00	
		450.00
Brick partitions and walls: 1,150 cubic feet, at $0.60		690.00
Plumbing, sewerage, and water supply:		
19 water closets in place, at $60	1,140.00	
12 urinals in place, at $30	360.00	
19 water basins in place, at $35	665.00	
5 slop sinks in place, at $40	200.00	
17 showers in place, at $15	255.00	
3 bath tubs, at $70	210.00	
3 two-compartment wash tubs, at $75	225.00	
1 gallon hot-water boiler	130.00	
1 heater, $80	80.00	
Drains and sewer	500.00	
15 W. C. partitions and doors, at $30	450.00	
6 urinal partitions, at $10	60.00	
264 square feet of lath and plaster partitions for female bath rooms, at $0.40	105.60	
Pump house	350.00	
1 No. 10 Rider Erricson engine in place	525.00	
1 3,000-gallon copper-lined tank	250.00	
550 feet of 2-inch galvanized wrought-iron pipe in place, at $0.50	275.00	
100 feet 1½-inch galvanized wrought-iron pipe in place, at $0.40	40.00	
200 feet 1 inch galvanized wrought-iron pipe in place, at $0.25	50.00	
300 feet 3 to 4 inch galvanized wrought-iron pipe in place, at $0.18	54.00	
100 feet of new 12-inch V. P. in place, at $1	100.00	
		6,024.60
Buildings on roof:		
Building for accommodation of 29 guards	2,500.00	
Building for accommodation of officer in charge	1,600.00	
Prisoner's bath house	700.00	
Laundry building located in moat	450.00	
		5,250.00
Gas pipes and fixtures		1,200.00
		19,197.60
10 per cent for incidentals and contingencies		1,919.76
		21,117.36
Add 15 per cent contractor's profit to plumbing		903.00
Total		22,020.36

MERCEDES HOSPITAL.

Estimate No. 1, for operating room, $1,614. Project approved in civil file D. of C. No. 1303, June 26, 1900. O. C. E. file D. of C. No. 283.

Estimate No. 2, for installing a system of forced ventilation, $1,770. Project approved in civil file D. of C. No. 1236, August 2, 1900. O. C. E. file D. of C. No. 283–4.

Estimate No. 3, for the installation of a system of plumbing, sewers, electric-light plant, concreting and tiling three patios and rearrangement of existing laundry machinery, $26,650. Project approved in civil file D. of C. No. 1303, September 24, 1900. O. C. E. file D. of C. No. 283–13.

Estimate No. 4, for constructing two additional rooms, $2,800. Project approved in civil file D. of C. No. 1303, October 14, 1900. O. C. E. file D. of C. No. 283–25.

On August 29, 1900, in response to advertisement for tenders, bids were received upon plans and specifications prepared in this office for plumbing and electric lighting, only sixty days being allowed for completion of the contract, in order to have the work completed before assembling of the Pan-American Congress.

Digitized by Google

Comparison of bids.

Name of bidder.	Class 1.	Class 2, item 1.	Class 2, item 2.	Sum.
Purdy & Henderson		$17,000	$2.25 sq. m.	$20,875
J. B. Clow & Sons		14,250	2.00	17,650
Charles Thrall	$10,124			
O. B. Stillman	8,750			

Lowest bidders:	
Plumbing, J. B. Clow & Sons	$14,250
Concrete and tile floors, J. B. Clow & Sons	3,400
Electric-light plant, O. B. Stillman	8,750
Total	26,400
Estimated cost of proposed work	23,176
Excess of estimate	3,224
Estimated cost of superintendence	1,000
Deficiency	4,224

This difference between the estimated cost and bids was due to:

(1) Scarcity of bidders, (2) to the added projects and absolutely necessary features embodied in the final plans not originally estimated upon, consisting of a general bath room, nurses' toilet and bath room on roof, and a hot-water system throughout, and to rock excavation in sewer lines developed by test pits.

In reporting the bids to the military governor, the chief engineer stated that, notwithstanding the increase in costs, this department stood ready to perform the work at the original price, and within the required time, but on account of the great mass of work on hand, deemed it expedient to contract with the lowest bidders. The military governor ordered the work done by hired labor, reconsidering his decision when James B. Clow & Sons reduced their figure by $1,000 and O. B. Stillman agreed to substitute another boiler for the one bid upon.

Mr. Stillman's bid was based upon a boiler not considered adaptable to the existing conditions, for reasons fully detailed at the time. On stating the objection to the boiler to Mr. Stillman, he offered to furnish a Worthington 100-horsepower boiler, in place of the boiler on which he bid, for an increase of $650 over the amount of his original bid, making the cost of the entire work and materials called for in class No. 1, $9,400, which was $724 less than the proposal of the next lowest bidder. By comparison with the cost of erecting the same boiler at other places, it was found that the price of Mr. Stillman for erecting the Worthington boiler, $2,700, was reasonable. The price of the boiler to be erected, as shown by estimate was, $1,999; both prices were verified. The increased cost of Mr. Stillman's modified proposition will be seen to be $51 less than the difference of cost of boilers This proposition was accepted as above stated, and contract was entered into with Oscar B. Stillman to perform the work mentioned in class No. 1, October 12, and approved October 18, for $9,400.

The sewers as built include one system for surface and roof drainage, and discharge into the porous commons beyond the brow of the adjacent hill. The sewage is carried by another system into the new line of sewer now being constructed by the sewer department, from Hospital No. 1 to the sea.

The contractors for the plumbing, concrete floors and sewers, prosecuted the work in a more or less desultory manner until a week or two prior to expiration of contract time, when much energy was displayed, the system being put in complete operation on January 5, with but a few slight minor details incomplete. By authority of the military governor, thirty days, extension of time was granted for the finish of the trifles, and a payment of $16,500 made to contractors.

It is a pleasure to be able to state that the contractors, James B. Clow & Sons, and their manager, Mr. Sylvester Scovel, displayed throughout an earnest endeavor to do honest work.

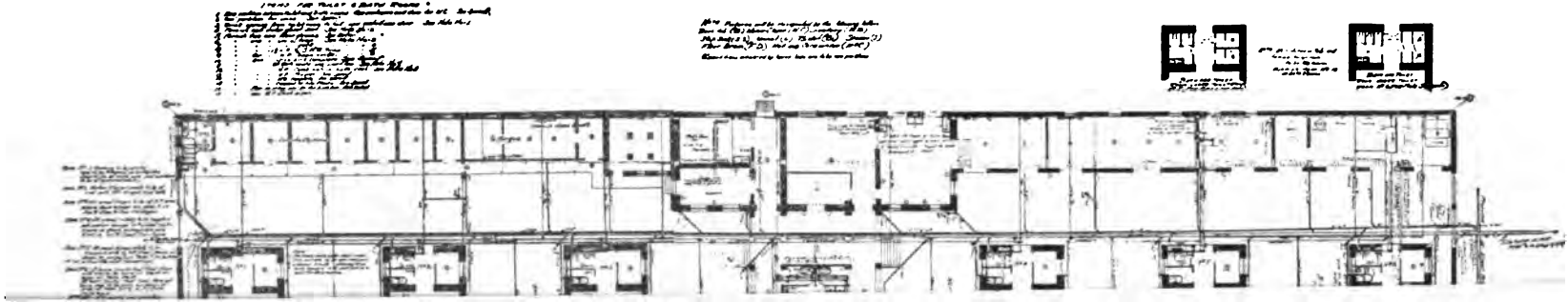
In finishing up the plumbing at Mercedes Hospital, several items of work were found which were not provided for in the estimates. Some of these items were omissions by this office, others the result of change of original plans, and still others were new work asked for by the hospital authorities. It was deemed advantageous to do this work, and the proposition of J. B. Clow & Sons to install it complete for the sum of $962.76 was accepted, and the work ordered done December 28, 1900 (civil

Digitized by Google

MERCEDES HOSPITAL, HABANA.

Digitized by Google

Digitized by Google



Digitized by Google

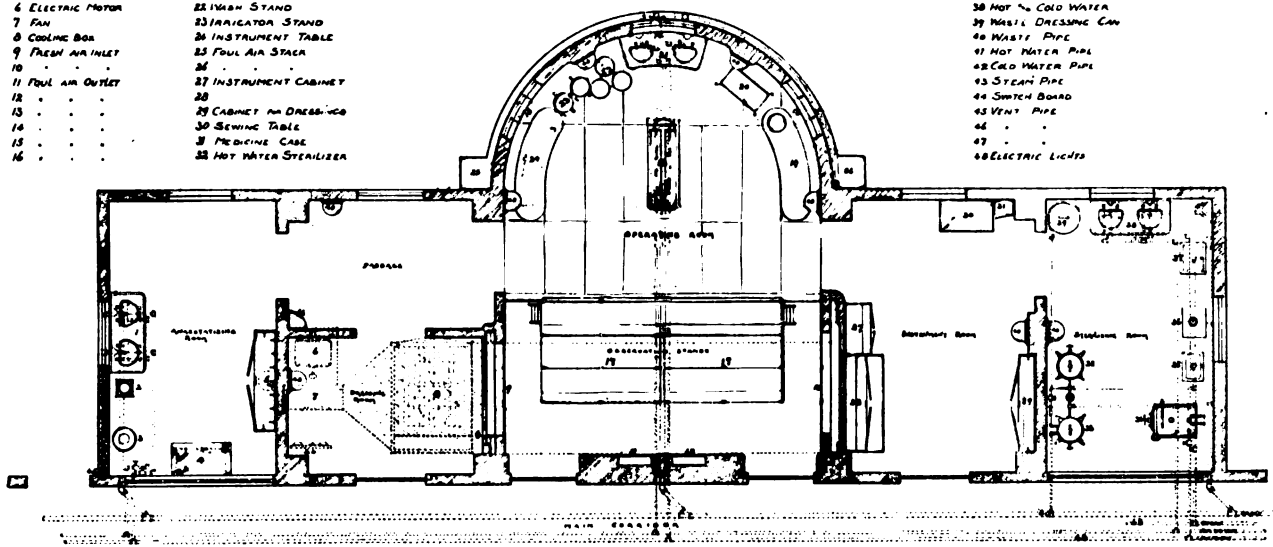
Digitized by Google

INDEX —

1 HOT & COLD WATER
2 IMMERSION BOWL
3 WASH BASIN
4 TOWEL TABLE
5 ASEPTIC WARDROBE
6 ELECTRIC MOTOR
7 FAN
8 COOLING BOX
9 FRESH AIR INLET
10 . . .
11 FOUL AIR OUTLET
12 . . .
13 . . .
14 . . .
15 . . .
16 . . .

17 OBSERVATION STANDS
18 OPERATING TABLE
19 DRESSING TABLE
20 IMMERSION TRAY
21 HOT & COLD WATER
22 IVSON STAND
23 IRRIGATOR STAND
24 INSTRUMENT TABLE
25 FOUL AIR STACK
26 . . .
27 INSTRUMENT CABINET
28
29 CABINET FOR DRESSINGS
30 SEWING TABLE
31 MEDICINE CASE
32 HOT WATER STERILIZER

33 COLD WATER STERILIZER
34 STERILIZER FOR DRESSINGS
35 INSTRUMENT STERILIZER
36 ALCOHOL LAMP
37 INSTRUMENT STERILIZER
38 HOT & COLD WATER
39 WASTE DRESSING CAN
40 WASTE PIPE
41 HOT WATER PIPE
42 COLD WATER PIPE
43 STEAM PIPE
44 SWITCH BOARD
45 VENT PIPE
46 . . .
47 . . .
48 ELECTRIC LIGHTS



PLAN OF OPERATING ROOM
REINA MERCEDES HOSPITAL
HAVANA, CUBA

Office of Chief Engineer
Department of Cuba

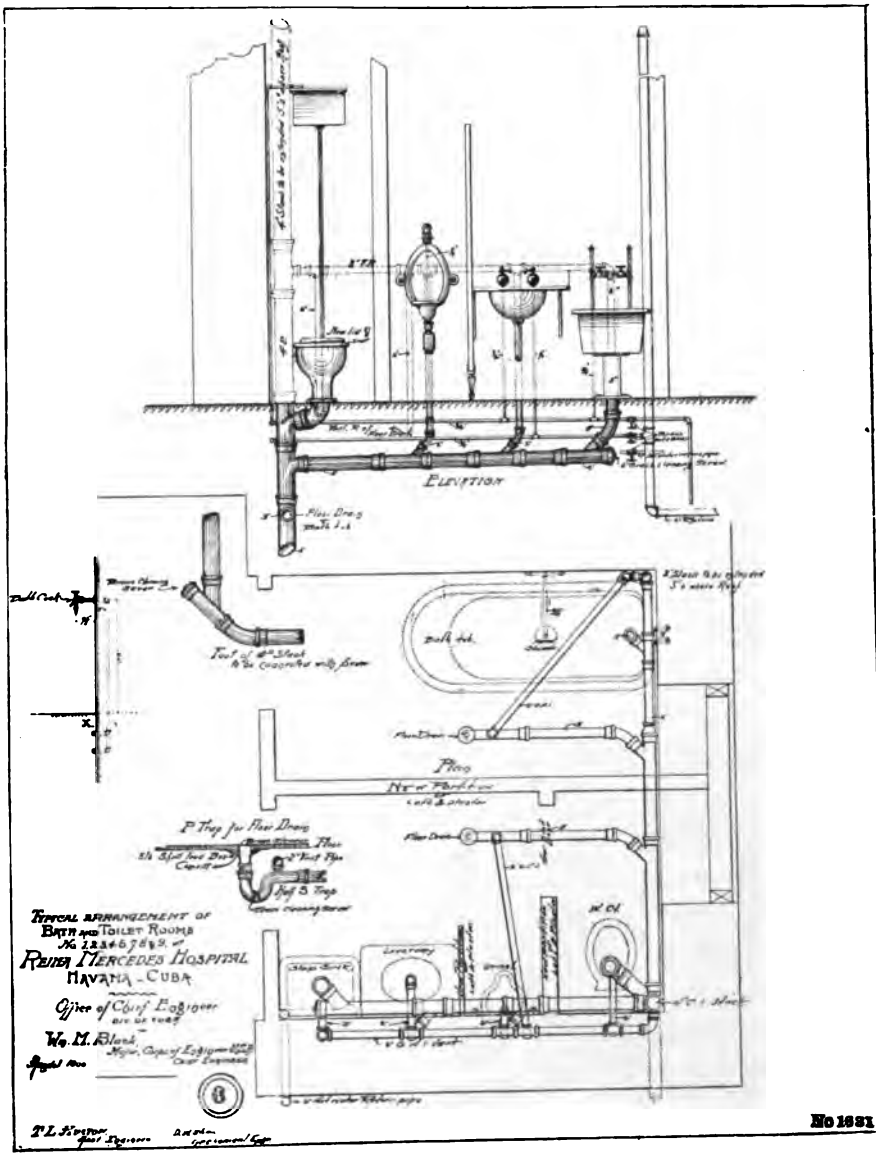
W^M A. Black
Maj Corps of Engineers U.S.A
Chief Engineer

V.E. Houton
Assistant Secretary

1898

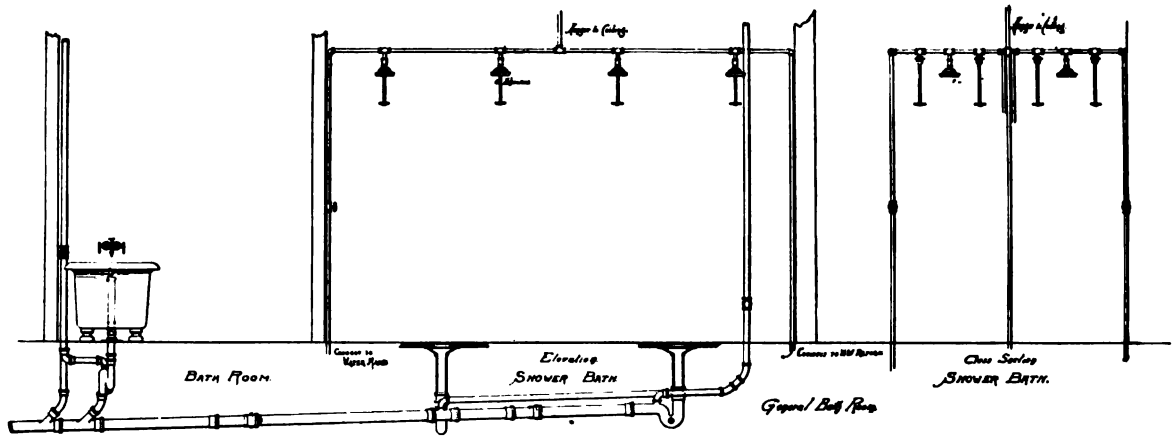
Digitized by Google

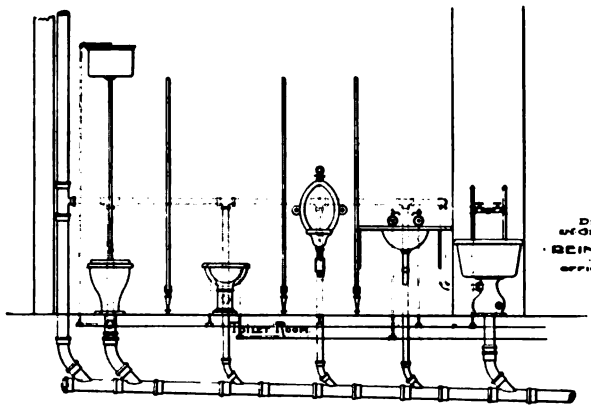
Digitized by Google



Digitized by Google

Digitized by Google





Details of Plumbing in General Bath Room
REINA MERCEDES HOSPITAL
Habana, Cuba.
Office of Chief Engineer
Div. of Cuba.

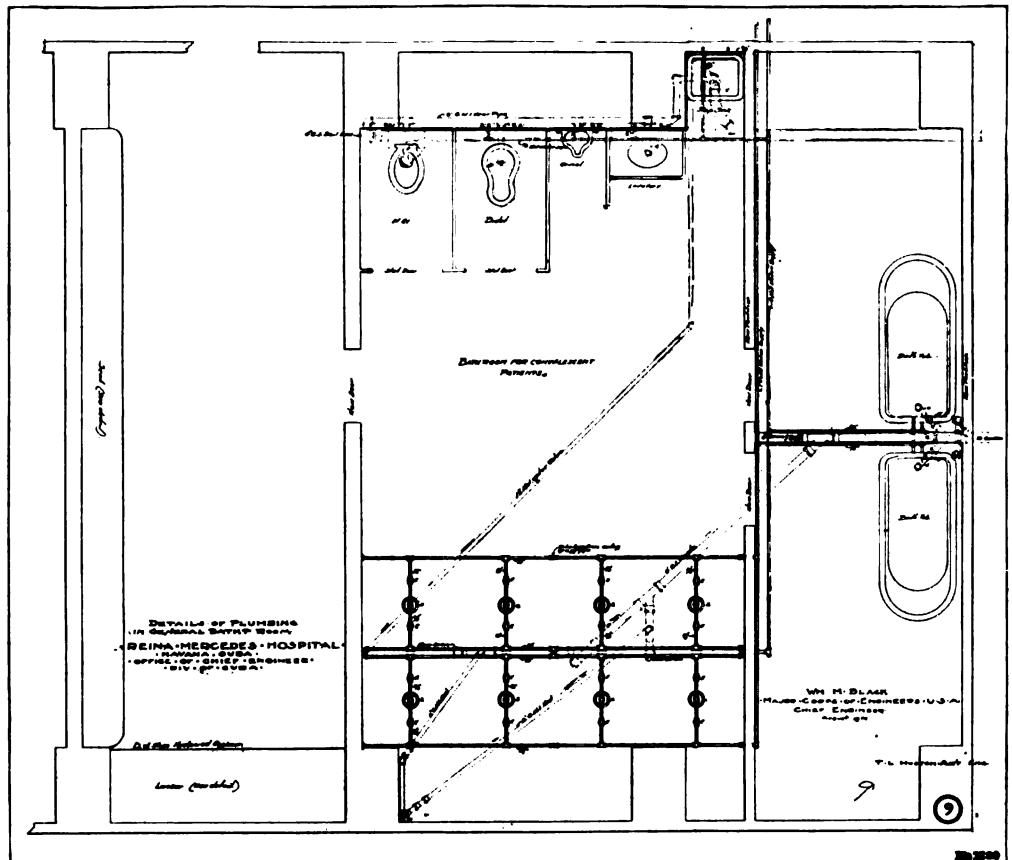
Wm. M. Black
Major Corps of Engineers U.S.A.
Chief Engineer
Aug. 1st 1901

No 1822 (8)

REINA MERCEDES HOSPITAL, HABANA.

Digitized by Google

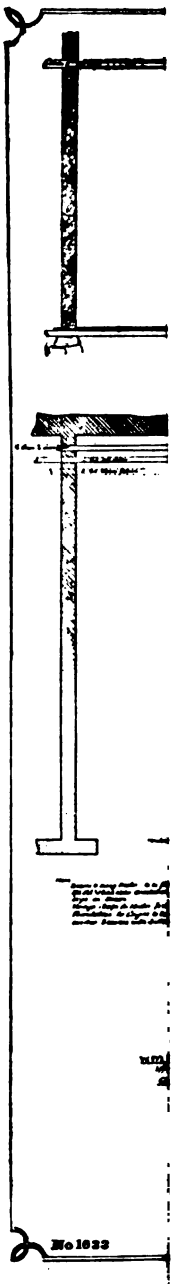
Digitized by Google



REINA MERCEDES HOSPITAL, HABANA.

Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google

MERCEDES HOSPITAL. ROUGHING IN.

Digitized by Google

Digitized by Google

file D. of C. No. 1303; O. C. E., file D. of C., No. 283–44), the work to be completed within twelve days. The items of this work enumerated in original propositions are as follows:

A. American nurses' bathroom, complete	$600.66
B. Waste and vent line to morgue room, complete	76.10
C. Drain line to cooling room, complete	20.00
D. Sink in room adjoining kitchen, complete	33.00
E. Basin in chief nurse's room, complete	45.00
F. Basins in nurses' room, ward No. 6, complete	45.00
G. New basins in doctor's room, ward No. 6, complete	45.00
H. White tile finished moldings, complete	55.00
I. Pantry sinks, nurses' dining room, complete	88.00
	1,007.76
Reduction	45.00
Difference	962.76

It is believed that when this work is completed the plumbing arrangements will be complete, sanitary, and satisfactory.

The additional work added to original estimate and not contained therein consists of nurses' toilet room and general bathroom.

Nurses' toilet room on roof: To properly provide for the needs of the nurses and to obtain room for sleeping quarters, it was deemed necessary to erect a room on the roof adjoining the sleeping rooms. The room as designed is in plan 26 feet 6 inches by 12 feet 6 inches, and 18 feet 5 inches high; floor space 331.25 square feet, and cubic contents, 6,090 cubic feet. It was designed to be made with expanded metal and stud partitions, plastered inside and out, and to preserve the same lines and general appearance as adjoining rooms. The inside walls were to be plastered with cement plaster, dressed smooth, and painted with enamel paint. Outside walls rough dressed. The room was to be provided with 3 basins, 2 showers, and 2 closets. The description and details are shown in plans, and recited in specifications. This work was let by contract to James B. Clow & Sons, at the same time as other contract.

General bathroom: General bathroom is located on the first floor, in the central part, near the west end, and consists of 8 showers, 2 bath tubs with showers, 2 water-closets, 1 urinal, 1 bide, and 1 slop sink; hot and cold water throughout; walls and partitions painted with enamel paint, and the flooring of tile.

Electric-light plant: As erected, electric-light plant consists of one 100-horsepower Worthington water tube boiler; one 4½ by 2¾ by 4 Barr boiler feed pump; one 4½ by 2¾ by 4 Barr low-service circulating pump; one Korting injector; one 150-horsepower Cochrane feed water heater; one Shepherd vertical automatic engine, 70-horsepower at 400 revolutions, 8 by 14 by 9 stroke direct connected to 35 kilowatts; C. and C. slow-speed multipolar dynamo; one 15-horsepower vertical nagle engine for operation of laundry 16-candlepower lights. This work was done under the supervision of Mr. George Brownson Rea, and the delay in the completion of the work has been occasioned by nonarrival of machinery from the United States, but as that is now delivered, it is expected that the contract will be completed on time.

Operating room: The conditions imposed by the medical authorities to obtain a properly lighted, well-ventilated operating room with absolutely impervious walls are such that the cost appears out of proportion to the size of the room treated. To obtain a light not too brilliant, the roof of large bay window is composed of ground glass one inch thick, laid in specially prepared putty upon steel tees. The windows are also of ground glass. To secure impervious surfaces in the room, to permit of easy washing, the floor is laid with heavy rough glass, and the walls are plastered with a mortar composed of equal parts of marble dust, plaster of paris, and cement, and will be painted with enamel paint. All doors and windows will be flush with walls, and the intersection of walls and floors will be rounded off to prevent accumulation of dust; except in operating room, the floors are of expanded metal and concrete upon railroad iron.

The design and installation of the ventilating system, has been attended with many difficulties: The air must be filtered; the velocity must be very low to avoid possibility of drafts; the speed of fan must be low to reduce noise to a minimum; action must be positive and responsive to demands, and the air must be cool. A maximum of 30 people will be in the room at one time, and 4,000 cubic feet of air (reasonable quantity for hospitals) must be furnished per hour to each person, a total of 120,000 cubic feet per hour, or 2,000 cubic feet per minute, and at a velocity of 2 feet per second a discharge area of 17 square feet is required. A fan 4 feet in diameter operated by 6-horsepower electric motor, with a storage battery to supply current for four hours (for a possible two operations of two hours each), will be

Digitized by Google

placed in basement under an adjacent accessory room. Air will be taken through window at a shaded entrant angle of building, forced through filter box with cheesecloth screens, exchangeable for washing purposes, into a main horizontal air duct 18 by 36, thence to risers 6 by 75 inches, located in two partitions and carried to discharge openings 13½ feet above floor. The air entering at a constant pressure circulates through room thoroughly, and passes out at flue openings located slightly above floor level. Flues are carried up to above roof level. The arrangement is ideal but expensive. Two thousand cubic feet of air per minute weighs at 72° F., $149\frac{1}{16}$ pounds, and will require 204 heat units to raise or lower the same 20° (from 90 to 70), or 1½ pounds of refrigeration per minute. Assuming that some days there will be two operations of two hours each, there will be required to cool the ice box primarily and the air when circulating 500 pounds of ice on such days. An ice box, shown on accompanying plans, is designed to cool the air before entering operating room. In order to arrive at size of fan, it was necessary to make experiments to ascertain loss in friction due to passage of air through screens. Sketch of apparatus used is herewith:

Data obtained from fan experiments made to determine resistance and loss of efficiency, due to screening air drawn through No. 2 cotton duck.

Revolutions per minute.	Vacuum in inches.	Calculated discharge without screens.	Calculated discharge with screens.	Percentage of loss.
290	1-8	345.1	126.7	.....
360	3-16	428.4	337.9	21
500	7-32	595	380.2	36
680	11-32	809.2	676.8	16
800	11-16	952	844.8	11

Calculation of fan requirements and conditions.

Temperature of air blower		76
Size of duct at blower, as designed	square feet	1.36
Calculated frictional loss:		
Ducts	ounces per square inch	.236
Cooler	do	.139
Screens	do	.100
		.465
Total pressure at blower	ounces per square inch	.50
Area of screens through which air enters:		
Interior	square feet	11.9
Velocity of air at entrance to room	feet-second	2.75
Velocity of air at blower	do	2.6
Fan:		
Number revolutions per minute		300
Diameter of fan wheel	inches	36
Length of blade	do	12
Width of blade	do	9
Diameter of inlet	do	18
Output of fan	cubic feet per minute	2,800
Amount of air required	do	2,600

Specifications.—For ventilating system for operating room at Mercedes Hospital. The ventilating system shall consist of a series of galvanized-iron air ducts of dimensions shown on plans. The contractor is to furnish all necessary labor and material for the complete installation of the plant as herein specified. One steel-plate right-hand fan, bottom horizontal discharge, direct connected to electric motor of Sturtevant manufacture or its equal. The fan will be 36 inches in diameter, direct connected to the multipolar, 110 volt, direct-current motor. The motor to be first-class in every respect, and of horsepower capacity, and to be run at 400 revolutions per minute. The armature will be what is known as ironclad, the coils of which will be machine-wound and held in place by hard-fiber strips. There will be provided for the motor one speed controller, one ammeter, one volt meter, one double-pole switch, and main cut-out. The controller is to be of such a design as necessary to allow three different rates of speed—300, 400, and 500 revolutions of the fan per minute. All air ducts will be built of what is known as No. 20 galvanized sheet iron, properly riveted and soldered to make air-tight joints, etc. All ducts will be properly braced where necessary to preserve their form, the braces to be riveted in place and to be of such material and forms as found necessary. All joints will be made by the use of one

Digitized by Google

and one-half inch angle iron, riveted to the ducts and bolted together with soft rubber gaskets. All ducts, both inland and outlet, will be provided with screens of such construction as shown on detail drawings. All ducts or air pipes will have two coats of red-lead paint on the outside after being put in place, the same to be done by the contractor. The construction of the various ducts and connections will be such in general design as shown on detail drawings. There will also be provided one cooling box, to be built of wood, with galvanized-iron drip pipes, the construction of which will be such as is shown on detail drawings of the same. There will also be provided a storage battery of 250 amperes capacity when discharging at its normal rate of 25 amperes at 110 volts. The battery will be provided with all the necessary instruments, volt, ammeter rheostats, etc., for charging and controlling the same. These instruments all to be mounted on a marble panel to be located in the fan room.

Estimate of cost of forced ventilation for operating room, Reina Mercedes Hospital.

Galvanized-iron ducts	$522.00
Electric motors	350.00
Storage battery	220.00
Refrigeration and screens	75.00
Partitions and plastering	250.00
Fan	185.00
Total	1,602.00
10 per cent for incidentals	160.00
Grand total	1,762.00

This estimate was approved August 2, 1900, civil file D. of C. No. 1236, O. C. E. No. 283–4. Two thousand eight hundred dollars being the lowest local bid received for the system of ducts and flues, and it not being considered judicious to award work at $822 to a Philadelphia bidder, the work was done by hired labor at the arsenal, with labor that required training, at a cost of $850. (Authority, September 1, 1900, civil file 1303, D. of C., O. C. E. No. 283–8.) This work is now in place. The electric material has not yet arrived. The glass for floor and skylights was ordered from the States and arrived rather badly broken up. It was recut and used to best advantage, and the pieces unfit for use was replaced by others purchased in Habana.

Major Laine, attending surgeon of the division, desiring that two more rooms be built on either side of operating room, the following estimate was submitted and approved in second endorsement, October 13, civil file D. of C., No. 1303, O. C. E. file D. of C. No. 283–25. The work to be done by hired labor.

Estimate for two additional rooms to be erected at Reina Mercedes hospital operating room.

6 cubic yards excavating, at $1	$6.00
8 cubic yards concrete in foundation, at $8	24.00
1,350 cubic feet brickwork, at $0.60	810.00
122 square yards cement flooring, at $2	244.00
Eight 10-inch, 30-pound I beam 9 feet 6 inches long, 2,280 pounds, at $0.06, in place	136.80
Four 10-inch 20-pound I beam, 9 feet 6 inches long, 750 pounds, at $0.06, in place	45.60
130 yards expanded metal, at $0.60, in place	78.00
161 square yards concrete in roof, at $2	122.00
50 linear feet of 4-inch galvanized iron, D. S. Co	15.00
2 throat pieces, at $5	10.00
100 linear feet plaster molding, at $1.50	150.00
23 squares plastering, at $9	207.00
160 square feet window openings, at $0.75	120.00
120 square feet door openings	90.00
12 squares exterior plastering, at $9	108.00
Cutting 4 openings, at $20	80.00
4 wood centers for windows, at $10	40.00
Wood centers for arched fig'ng	40.00
4 door frames, at $6	24.00
Patching old masonry	50.00
Hardware, 4 doors and 4 windows, at $5	40.00
Painting 10 squares, at $3	30.00
Calcimining 12 squares, at $1	12.00
Cartage	50.00
	2,532.40
10 per cent for incidentals	253.24
	2,785.64

The great delay of the work has been occasioned, first in making experiments to determine size of fans and apparatus; second, delay in obtaining bids for ducts, etc., and time finally consumed in making same; delay in getting glass from the United States. The medical authorities, desiring special design of fixtures, have themselves

Digitized by Google

ordered the plumbing and electric-light fixtures. The operating room is now completed, excepting the electrical apparatus, which is daily expected.

Financial statement:

Total approved estimate of cost of work	$33,419.64
Total allotments received	7,369.64
Total expenditures	5,893.95
Balance unexpended December 31, 1900	1,475.69
Outstanding liabilities	27,716.55

D. W. Shea was in charge of work, but final inspection was made by J. W. Cousin and J. W. Shaffer.

Data of cost, electric-light plant, Mercedes Hospital:

Amount of electric-light contract	$9,400.00
Cost of material furnished by department	1,575.26
Cost of material purchased	1,314.00
Total cost of plant	12,289.26
Total number of arc lights installed	6
Total number of incandescent lights installed	348
Equivalent to 664 16-candlepower lights.	

Average cost per light $18.30 (including machinery and all other costs).

Distribution, quantities: 2 six-light clusters, 2 five-light chandeliers, 4 two-light brackets, 156 one-light brackets, 138 one-light drops, 24 one-light toning drops, 7 switch boards, 950 feet No. 0 wire, 2,110 feet No. 3 wire, 3,400 feet No. 4 wire, 1,750 feet No. 8 wire, 970 feet No. 10 wire, 30,775 feet No. 14 wire, 1,540 feet long cord. Total number of feet of conductor, 41,495. Average cost of plant per linear foot of conductor, $0.293.

Tower to inclose water tank on Cabana heights: Estimate for erecting a tower of expanded metal and plaster on wood studding around water tank located on Cabana heights, $3,982.61. Project approved in civil file D. of C. No. 1236, O. C. E. file D. of C. No. 765.

In compliance with orders from the military governor, drawings were prepared on December 15 for a tower to be erected around water tanks on Cabana heights. The tank to be inclosed is of steel, 30 feet in diameter at the base and 43 feet in height, and was erected by the engineer department for the purpose of supplying water to the inhabitants of the northeast side of the bay. Its present location was selected, owing to the elevation which furnished the required head of water, but which placed the tank in a conspicuous position, surrounded by fortifications and structures erected during the eighteenth century. The tank detracted from the stately appearance presented by these structures, and in order to cover up this blemish it was thought advisable to erect a tower around the tank that would conform in style and appearance and in keeping with the surroundings. The tower will be constructed of expanded metal and cement mortar, over a framework of wood studding, and will be 45 feet square at the base and 48 feet in height, with a 6-degree batter on the side walls. A heavily molded projecting base will be formed at the lower part of the tower, and at the top a projecting parapet supported on heavy brackets. At one corner of the tower, projecting from the parapet, a circular turret will be constructed, accessible from the interior by a wooden porch that will be extended around the interior of tower and partly over the top of steel tank. This porch will be reached by way of an interior spiral stairway in one corner of the tower. The stairway starts from a platform at a height of 9 feet from the ground, which leads through a heavy brass-mounted door to an exterior landing and stairs extending to the ground.

The project is now ready to be forwarded to the military governor for his inspection and approval.

Estimate:

25,000 feet B. M. lumber in place, at $55 per M	$1,375.00
14 cubic yards concrete in place, at $10	140.00
115 pounds bolts in place, at $0.12	13.80
122 squares expanded metal and plaster in place, at $12	1,464.00
115 linear feet galvanized-iron gutter in place, at $0.35	40.20
100 linear feet galvanized-iron leaders in place, at $0.25	25.00
30 linear feet pipe railing in place, at $0.75	22.50
Outer staircase (20 treads), at $6	120.00
25 square feet door area, including frame, at $1	25.00
Spiral stairway (60 treads), at $3	180.00
4,000 feet B. M. scaffolding in place, at $35	140.00
Hauling	75.00
	3,620.55
10 per cent for incidentals	362.06
	3,982.61

Laboratories of the University of Medicine: Estimate No. 1, for fitting up buildings known as quartermaster's storeroom No. 6, as laboratories for the University of

Digitized by Google

Medicine, $24,505; project approved in civil file D. of C. No. 1236, Oct. 16, 1900, and O. C. E. file D. of C. No. 478–1. Estimate No. 2, for grading grounds and placing ornamental fence and gate in front of building, $3,700; project approved in civil file D. of C. No. 1236, Dec. 6, 1900, and O. C. E. file D. of C. No. 478–4. Estimate No. 3, for plastering outside of east and west wings, $1,500; project approved in civil file D. of C. No. 5013, Dec. 24, 1900, and O. C. E. file D. of C. No. 478.

October 5, 1900, a communication accompanied by sketches prepared by Dr. Agramonte, A. A. Surgeon, United States Army, was presented to this department, with instructions to proceed at once with plans for the remodeling of the buildings situated on Carlos III, opposite the Quinta de los Molinos, and recently designated as Quartermaster storehouse No. 6, to be used as laboratories for the University of Medicine. These buildings were built by the Spanish Government, in the early nineties, on grounds of Camp Animas, and a small portion purchased from the heirs of Count Peñalver, and were a part of a project presented by General Osoris, and approved by the war office, which called for the expenditure of $500,000 for barracks for the Spanish engineers. This, however, was stopped before completion, on account of the war, after some $50,000 had been expended on the work.

As they existed when brought to the attention of this department, there were three brick buildings: A main building 31 feet 6 inches by 207 feet 6 inches, plastered inside and out, with the entrace in the center, and a colonnade extending its entire length in the rear, and two wings, each 31 feet 6 inches by 101 feet 6 inches flanking the east and west ends of the main building and forming a quadrangle in the rear. These two wings were to have been provided with colonnades similar to that of the main building, which, however, were never erected.

As intended by the original project, the main building was to have been used as regimental and administrative offices, the east wing as a band room and the west wing as a regimental school, while eight other buildings were to have been erected in the rear as quarters for the various companies, with various other accommodations, as shown on the plan. The original intentions, however, were diverted, and the buildings were given over to hospital uses during the war, and after the American occupation to the uses of the Quartermaster Department. That work had suddenly been postponed, is clearly evidenced by the unfinished state in which it had been left, the two wing buildings never having been plastered inside or out, or the crowning parapets completed. As a result of neglect and misuse, everything was in exceedingly bad condition when it was brought to the consideration aforementioned.

Project: The proposed project of alterations and additions was to provide working laboratories for the study of histology, bacteriology, general chemistry and physics, together with a lecture room, museum, and the other necessary appurtenances which go to make up well-equipped laboratories, and, being the first of its kind in Cuba, it was desirable that everything should be the most modern and the most convenient that the existing conditions would permit.

Plans and estimate: Measurements were taken and sketches prepared showing the general arrangement of the laboratories, and the various types of furniture upon the lines suggested by Dr. Agramonte, and, after thorough consideration and a few modifications, an estimate was approximated showing the sum of $31,200 to be necessary for the execution of the work. This estimate, in addition to the project hereinafter described, provided for the extension of the east wing for toilet purposes, and the ceiling overhead of all the buildings, which, though desirable, were not absolutely necessary. These two items, Nos. 8 and 10, not being favorably considered, were omitted, which made a reduction of $6,715, rendering the estimated cost of the improvements $24,505, as follows: This estimate was submitted to the military governor October 16, 1900, and returned approved the same day, whereupon working plans were at once prepared, and operations commenced October 27, 1900. As approved, the project provided for:

I. The erecting of the colonnades for the east and west wings.

II. The removing of old partitions in the main building, the erecting of new, both in main building and wings, and the plastering of walls in the east and west wings.

III. Glazing and repairing old windows and doors.

IV. Concreting main entrance and floors of all porticos, new and old.

V. The installation of a system of gas and electric lighting.

VI. The installation of a system of plumbing.

VII. The construction and installation of furniture and fittings.

VIII. General repairs to floors, existing plaster work, partitions, new woodwork finish, etc.

IX. Painting.

Digitized by Google

DESCRIPTION.

Bacteriological laboratory.—The bacteriological laboratory, as will be seen from the plans, occupies the west half of the main building and consists of a general laboratory 15 by 83 feet, a professor's room 15 by 15 feet, 2 laboratories for advanced workers, each 15 by 15 feet; a library 15 by 15 feet, and 2 animal rooms, one 15 by 15 feet, the other 10 by 15 feet. The general laboratory is provided with working counters, the entire length of one side and end, with 38 drawers, and shelf racks divided into 38 separate divisions, thus furnishing accommodation for 38 workers, with ample facilities for twice that number, without inconvenience. Besides these working counters there are also provided 4 tables, each 4 feet wide and 12 feet long, containing 8 drawers, 1 table 2 feet wide and 16 feet long with 6 drawers, 2 cases for instruments and supplies, each 10 feet long and 7 feet 6 inches high, with cupboards below and shelves with glazed doors above, and 3 porcelain sinks, one 20 by 36 inches, the other 14 by 28 inches, supplied with water through nickel-plated brass pantry cocks. The professor's room contains a working table 8 feet long with a porcelain sink at one end and with drawers and shelf beneath; a case for instruments and supplies, 4 feet 6 inches long and 7 feet 6 inches high, with cupboards below and shelves with glazed doors above; a dust-proof closet, 4 by 6 by 6 feet high, for cultures, and a flat-top office desk. The advance worker's rooms are each provided with working counters around two sides, containing a set of 6 drawers and 2 cupboards, with a porcelain sink at one end, and also with a case similar to that described for the professor's room. The library, which is typical of all the departmental libraries, contains a bookcase 15 feet long and 6 feet high, sufficient for 600 or 700 volumes, also reading chairs with one wide arm to take the place of tables. The animal rooms are fitted with 11 iron cages, 3 feet 6 inches high, with a wooden counter forming the top; a pen 4 feet by 6 inches for small animals, such as guinea pigs, rabbits, etc.; a working table 2 feet 6 inches by 6 feet, and a galvanized iron sink, 20 by 36 inches, with hose connections. The floors of these rooms are of concrete construction on expanded metal, graded to a gutter which is also graded to discharge into a bell trap. The walls also have a cement finish, which allows for thorough flushing and washing of those rooms.

Histological laboratory.—The histological laboratory occupies the east half of the main building, and consists of a general laboratory 15 by 83 feet, two laboratories for advanced workers, each 15 by 15 feet, a professors' room 15 by 15 feet, a library, besides two rooms for the accommodation of the janitor. This laboratory, with the exception of the professors' room, which has no working counter or dust-proof closet, is similar to the bacteriological laboratory in all its appointments, but the general laboratory is provided with five tables, each 3 by 12 feet, in place of four 4 by 12 feet as originally planned. In addition there is a table 4 by 4 feet for the microtome.

Chemical laboratory.—The chemical laboratory occupies the entire east wing with the exception of the southwest corner, where all the toilet accommodations have been concentrated, and consists of a general laboratory 30 by 74 feet, a professors' room 12 by 14 feet, a library, storeroom and coat room. The general laboratory is provided with working counters, the entire length of two sides, containing separate desks with cupboards, drawers, and shelf racks for 16 workers. There are 8 porcelain sinks distributed between the desks. Extending through the center of the laboratory are 8 sets of working counters 4 feet wide and 16 feet long, each set containing 8 separate desks, and each provided with a cupboard, set of drawers, and shelf rack similar to the wall desks, making a total of 80 desks, accommodating 80 students. At the south of this laboratory are two ventilated hoods for experiments emiting obnoxious fumes. There are also provided two more procelain sinks, one at each end, which give ample accommodation for all ordinary purposes. A table 2 feet 6 inches by 5 feet is also located at each end of the laboratory, for scales, microscopes, etc. The professors' room contains a flat top desk and a case similar to those described for the other professors' rooms. The library is identical in appointment with the one already described. The storeroom is fitted with 100 feet of shelving for supplies, and the coat room is provided with 80 brass coat and hat hooks. Coat and hat hooks have also been provided for each of the other laboratories, and for each separate room.

Lecture room: The lecture room and museum complete the arrangement and are both located in the west wing. The lecture room, 30 by 44 feet, occupies the north end and contains a lecturer's desk mounted on a raised platform, 80 lecture-room chairs with a wide arm for notes and a blackboard 4 by 16 feet directly behind the desk. The museum, 30 by 55 feet, occupies the south end, and contains six cases 8 feet long, one 6 feet long, and one 15 feet long, all 7 feet 6 inches high. These cases

Digitized by Google

NORTHWEST CORNER LABORATORIES.

LABORATORY.

Digitized by Google

Digitized by Google

LABORATORY CASE, U. OF M.

Digitized by Google

Digitized by Google

MUSEUM, U. OF M., HABANA.

LECTURE ROOM, U. OF C.

Digitized by Google

Digitized by Google

DUST-PROOF CLOSET, BACTERIOLOGICAL LABORATORY, U. OF M.

HOODS, CHEMICAL LABORATORY.

Digitized by Google

Digitized by Google

CHEMICAL LABORATORY, U. OF M.

Digitized by Google

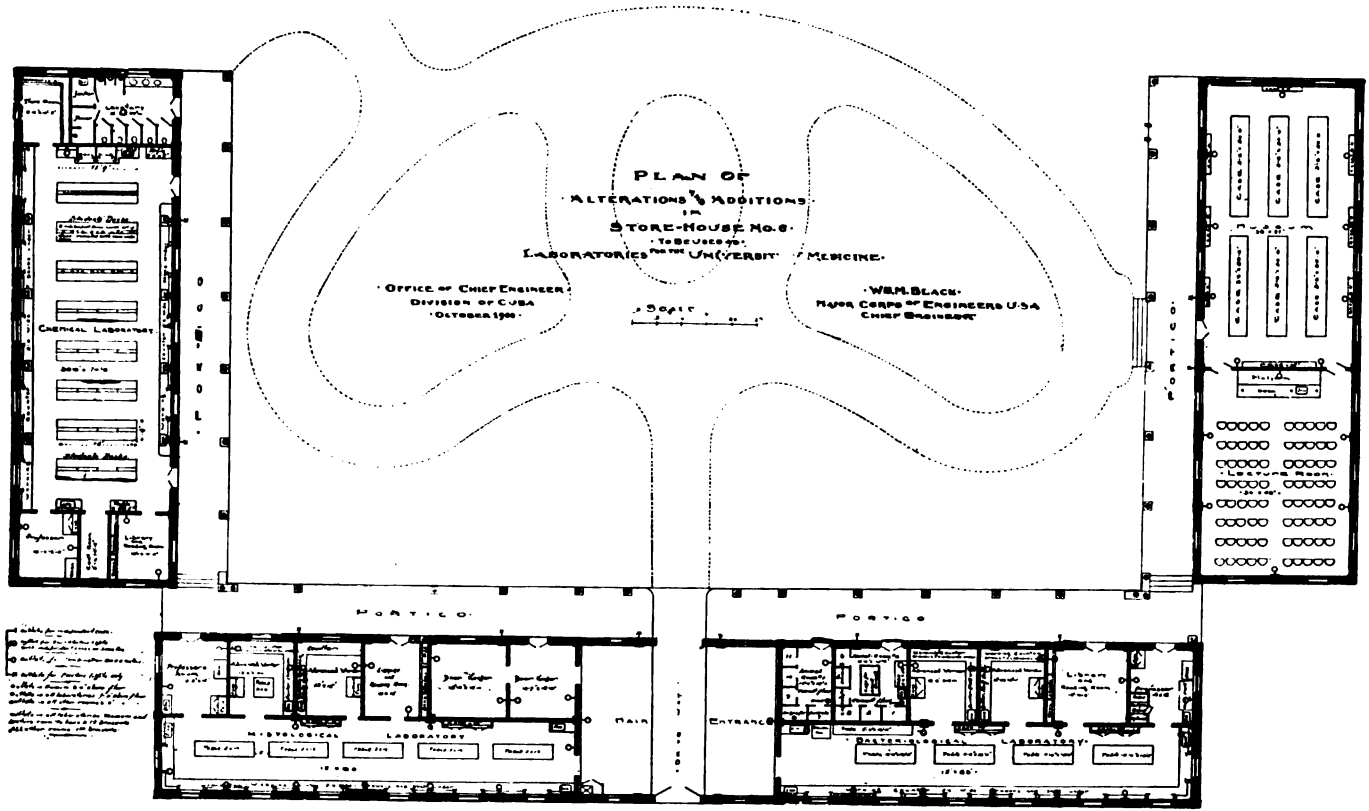
Digitized by Google

BACTERIOLOGICAL LABORATORY, U. OF M.

HISTOLOGICAL LABORATORY, U. OF M.

Digitized by Google

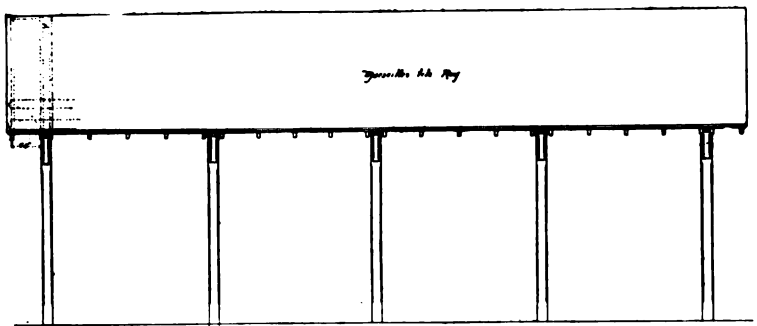
Digitized by Google



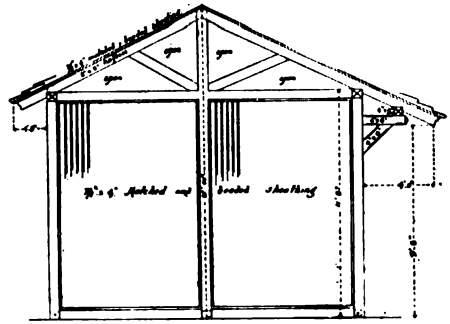
No 1630 (2)

Digitized by Google

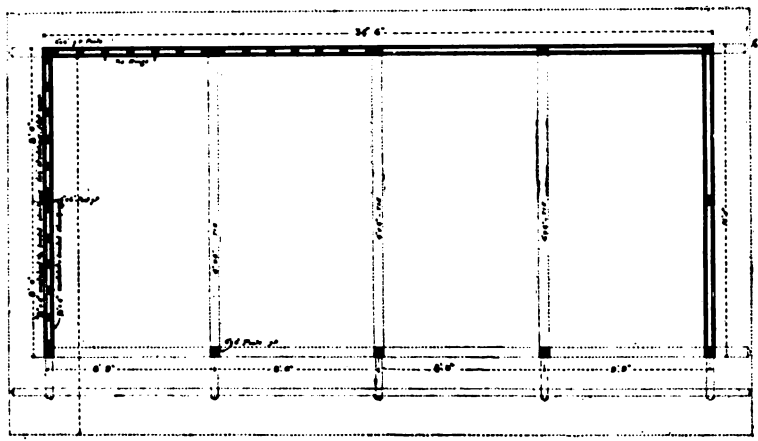
Digitized by Google



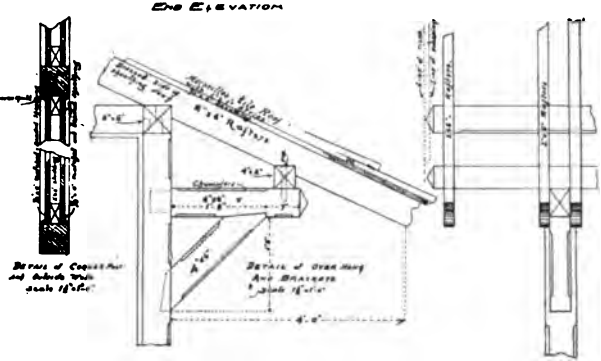
FRONT ELEVATION



END ELEVATION



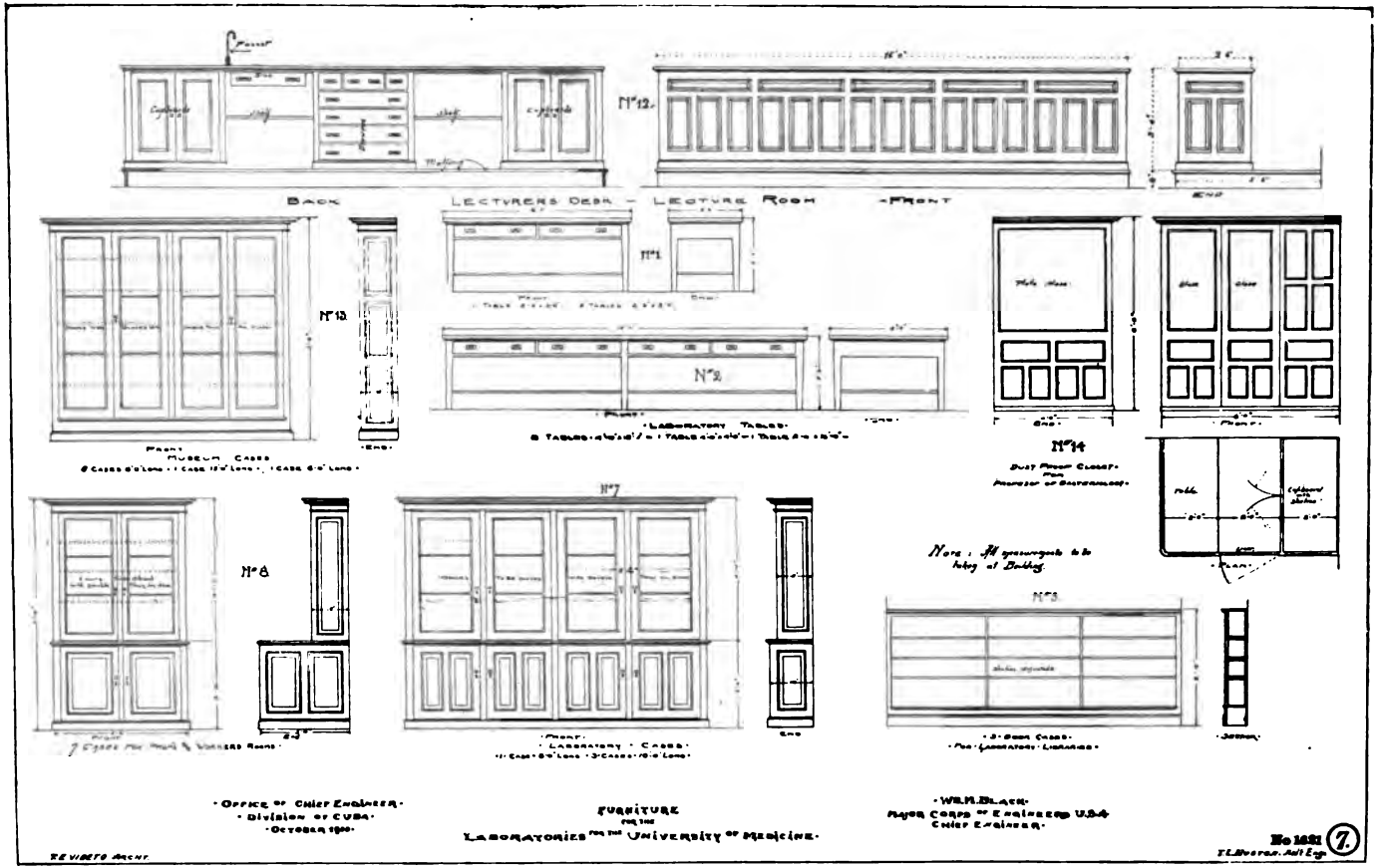
PLAN.



CARRIAGE SHED
LABORATORIES OF THE UNIVERSITY OF TORONTO.

No 1819

Digitized by Google

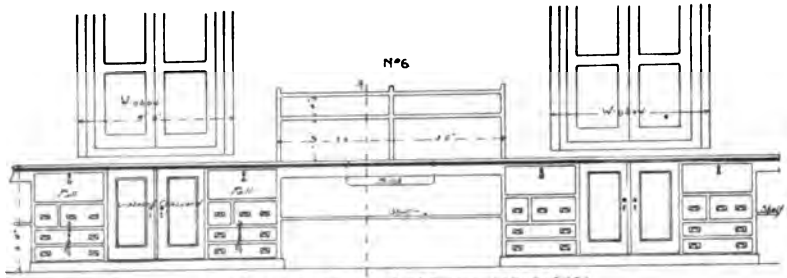

Front
Back
N°12.
Lecturers Desk — Lecture Room — Front
End
N°13
N°1
N°2
Museum Cases
Laboratory Tables
N°14
Dust Proof Closet
for
Professor of Bacteriology
Plan
N°8
N°7
Laboratory Cases
N°9
Note: All gasworks to be
kept at Bottom.
Office of Chief Engineer
Division of Cuba
October 1900.
Furniture
for the
Laboratories for the University of Medicine.
W.M.R. Black
Major Corps of Engineers U.S.A
Chief Engineer.
No 1421
7.
T.T. Rivero, Asst Engr.
Revised Sheet

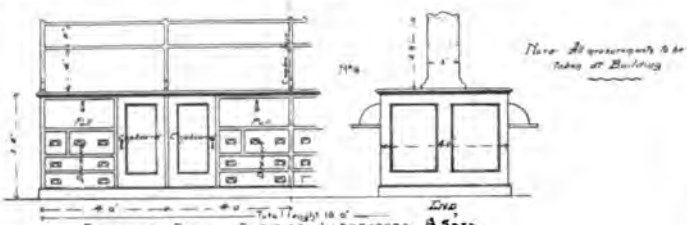
Digitized by Google

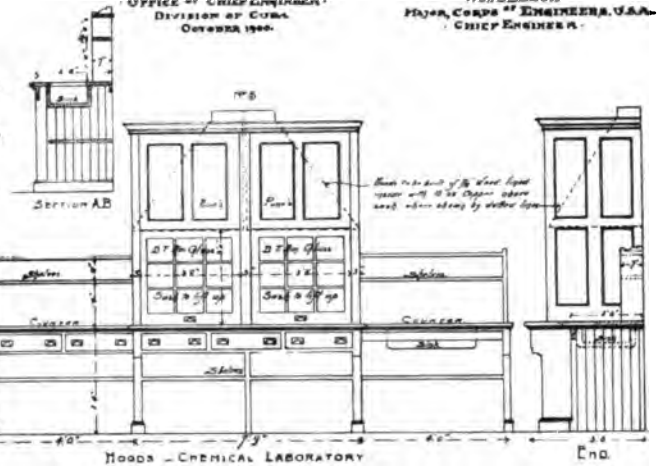
Furniture
for the Laboratories of the University of Medicine.

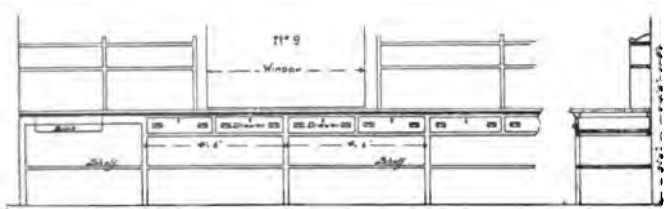
Office of Chief Engineer
Division of Cuba
October 1900.

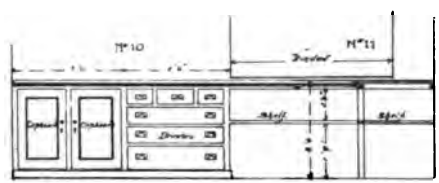
Wm. M. Black
Major, Corps of Engineers, U.S.A.
Chief Engineer R.

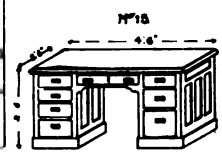












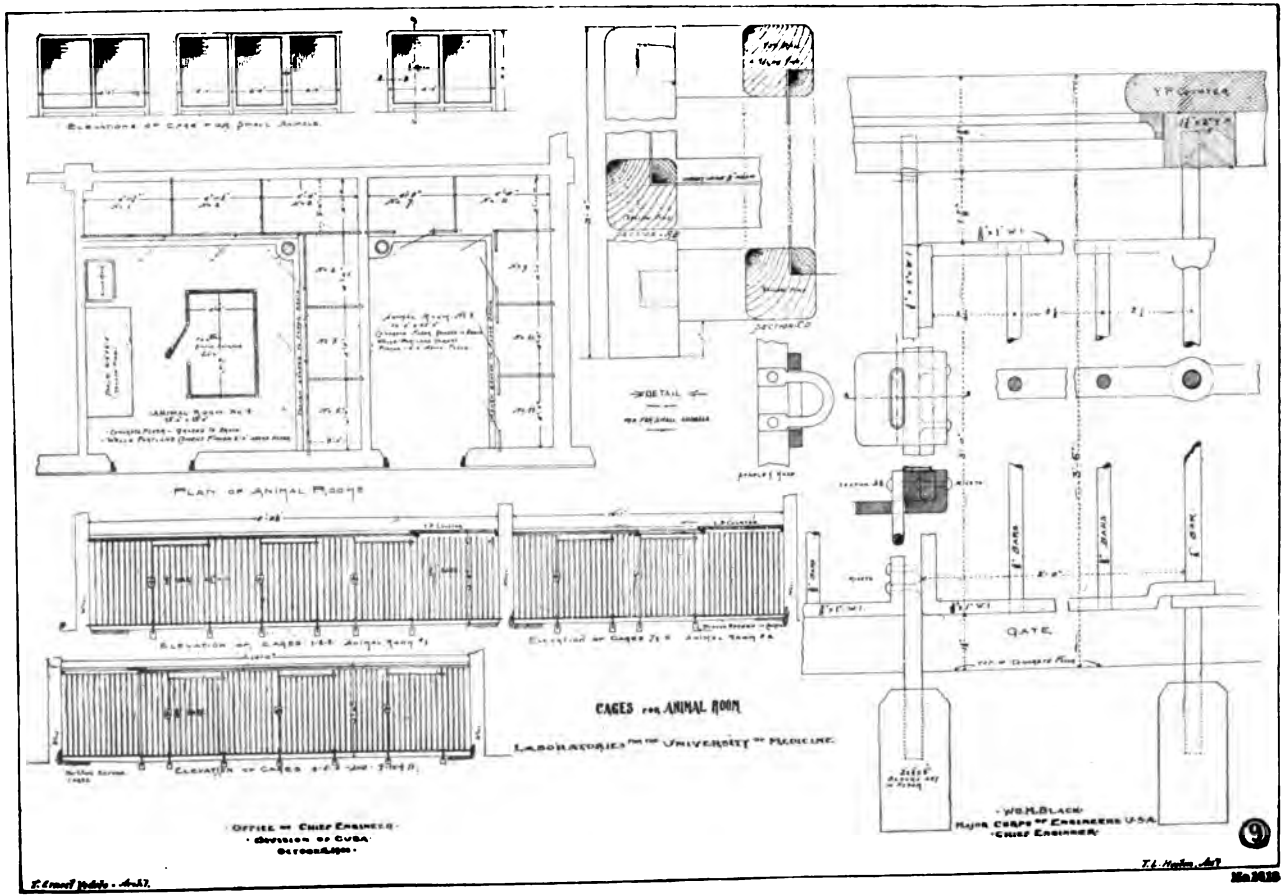
T. L. Norton, Asst Engr.

8

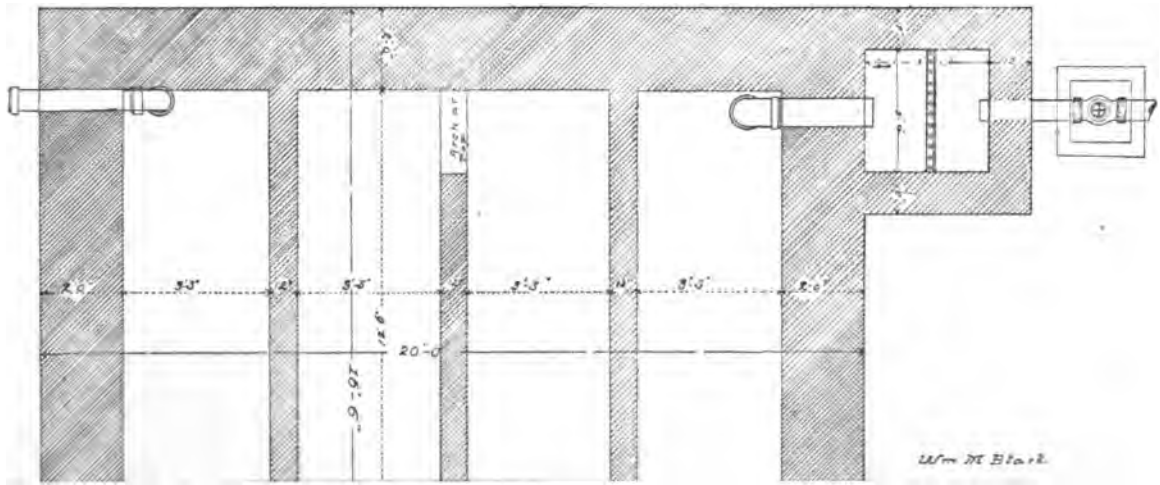
No 181.

Digitized by Google

Digitized by Google


PLAN OF ANIMAL ROOMS
DETAIL
GATE
CAGES FOR ANIMAL ROOM
LABORATORIES FOR THE UNIVERSITY OF MEDICINE
OFFICE OF CHIEF ENGINEER
DIVISION OF CUBA
HAVANA, CUBA
W.C.H. BLACK
MAJOR, CORPS OF ENGINEERS U.S.A.
CHIEF ENGINEER
9

Digitized by Google



Digitized by Google

Digitized by Google

are fitted with shelves and glass doors, and provide accommodations for a generous exhibit. In addition to these cases, it was intended to have four center cases, each 3 feet 6 inches wide, and 20 feet long, but the present requirements not justifying the expense, those cases were not provided.

I. Erecting colonnades: For erecting the two colonnades, each 200 feet long, 17 cast-iron columns were required, with drain connections with the roofs of same pattern as the already existing columns of the main portico. The roof was constructed of 2½ by 6 inch Y. P. rafters beaded on the under edge, resting on a 4 by 4 inch angle iron bolted to the walls, and secured to same by 4-inch lag screws through the horizontal leg, the outer ends resting on two 2¾ by 9½ inch Y. P. girders, secured to the columns by 4-inch lag screws, with ⅞-inch ship-lapped roof boarding of yellow pine dressed on under side, and covered with one thickness tarred paper, and 8 by 8½ inch red roofing tiles on a 4-inch base of coco filling, as commonly used for roofs of this description in this locality. The parapets of these colonnades were constructed of plaster on expanded metal and yellow-pine studding, the moldings formed by stretching the expanded metal over wooden lookouts, with a single row of flat roof tiles along the top to give a firm finishing edge. These parapets correspond identically in design with the original, which were constructed of masonry, and the difference in construction can not be distinguished in appearance, or identified, except by test with a tool.

II. To obtain the proper arrangement of rooms, it was necessary to remove nine of the old partitions in the main building, aggregating 2,210 square feet, or 1,105 cubic feet brick masonry, and the erection of nine new partitions of expanded metal and yellow-pine studding, aggregating 2,800 square feet, in the main building and wings. The interior walls of both east and west wings, 7,400 square feet, had been left unfinished, and in consequence required new plastering, which with the ceilings and animal rooms made 136 squares of new plaster work done in this building, besides the repairing and patching of old. Besides this, it was necessary to close up 5 old doors (250 square feet), cut 4 new openings for doors (200 square feet), change 4 exterior doors to windows, and 3 windows to doors. The doors and frames removed from the old partitions answered for the new openings, so that only 4 new doors and frames and 2 new window frames were required.

III. The old window sash and doors were paneled without any glazing whatever, but being in a condition to use it was considered advisable to use them, removing the wooden panels, and substituting glass. Fifty-six windows, each with 8 panels, and 9 pair of doors with 6 panels each and 1 pair with 2 panels were thus glazed, making a total of 504 lights of glass put in. In glazing these sash new moldings and other repairs and the smoothing up of the frames were necessary to put in condition for painting.

IV. The floor of the main entrance (1,200 square feet) and the floors of the portico new and old (4,300 square feet), a total of 55 squares, were concreted in the same manner as is usually done by this department. The face of the retaining wall of these porticoes (1,700 square feet) was in poor condition and required finishing with a coat of cement mortar. Two steps were necessary to overcome the difference in levels between the floors of the porticoes of the main building and wings, and 3 steps were made at the center of the west wing, these steps all being constructed of concrete with rounded nosings on the treads.

V. Electric and gas lighting: The buildings have all been wired for electric lighting and piped for gas. The general laboratories, lecture room, and museum have been furnished with 2-light combination gas and electric fixtures, 39 in all, while the other rooms are provided each with 2 single light combination brackets of design similar to the 2-light fixtures, 37 in number, while the portico is lighted by 10 single electric fixtures only. The electric wiring is divided into 5 circuits, controlled by a main switch board in the vestibule, and 1 in each laboratory and the museum. Where installed in partitions, the wires are all in an iron conduit, which makes it possible to install new wires should occasion require it. In addition to these lights a desk lamp has been provided for each desk, and 2 for the lecture desk. In addition to the gas lighting, the working counters of all laboratories, advanced workers' rooms, and professors' rooms have been piped for gas, connected with 145 hose cocks for supplying Bunsen burners.

VI. Plumbing: The laboratories throughout have been provided with a system of plumbing of the most modern type. There have been 23 porcelain sinks (17-14 by 28 inches and 6-23 by 36 inches) installed, each with nickel-plated wastes, overflows and traps, and supplied by water through heavy nickel-plated pantry cocks 16 inches high. Every trap is ventilated by a 2-inch galvanized-iron stack hidden in the walls and extending through the roof, which insures a thorough ventilation of the system and a free circulation. The toilet accommodations, as already mentioned,

Digitized by Google

have been concentrated in the southwest corner of the east wing, and comprise a lavatory of 3 porcelain-lined iron basins, each 14 by 14 inches in size, supplied with cold water through nickel-plated brass compression cocks; 5 washout closets, 3 urinals, 1 shower and 1 slop sink. The partitions in this room are of plaster and expanded metal with gas-pipe frame, as used in the other work which has recently been done by this department. In addition to the aforementioned fixtures, a galvanized-iron sink with back and legs complete, was provided for the animal room, also 2 bell traps for same, and a slop sink at west end of main building, while 4 hose cocks have been conveniently distributed on the exterior. A 4-foot C. I. soil line with 2-inch branches takes care of this system, while the water supply is furnished by a 2-inch G. I. line, which reduces to 1¼ feet at the wings with ½-inch connections with the various outlets.

Septic tank and sewage disposal.—To take care of the sewage from these buildings, it was necessary to run a 6-inch vitrified line, 941 feet long, discharging into a creek which crosses the grounds in the rear. Two hundred and fifty feet directly in the rear of the west wing a septic tank was located to receive this sewage, and to liquify it before discharging into the creek. This tank is 12 feet 6 inches by 16 feet inside measurements, with 24-inch walls and 6-inch bottom of concrete. It is divided by brick walls plastered with cement into 4 compartments 3 feet 2 inches wide, connected with the other by 2-foot arches alternately located at bottom and top. At the inlet a receptacle 3 by 3 feet with a bar-iron screen and a W. I. gate is provided to check solid matter and to close the tank, while the soil line is controlled by a 6-inch gate valve. Connecting this receptacle with the main tank is a 6-inch C. I. pipe, which reaches to within 12 inches of the bottom to give the fecal matter as long a flow as possible before entering the second division, which is connected with the first by a 2-inch arch diagonally across from the inlet. The second compartment is connected with the third by a 2-foot inverted arch at the top of the dividing wall diagonally opposite from its inlet, and the third with the last by a 2-foot arch at the bottom of the dividing wall. The outlet to this division is a 6-inch C. I. pipe at the top of the tank, which, however, is extended to within 12 inches of the bottom, thus causing the third and fourth compartments to siphon as soon as flow is created, and to continue until the water level is below the bottom of the pipe. As the first and second compartments can be emptied only to the height of the arch in the middle division, the sewage remains in the four compartments until thoroughly dissolved, and the level is raised to the height necessary to create siphonage in the third and fourth compartments. Thus all fecal matter is dissolved before discharging into the creek. This tank is so arranged that it may be enlarged at any time when it becomes necessary to take care of additional sewage for any new buildings which may be erected. Provisions were also made by a change in grade of sewer at a point 625 feet from the septic tank for filter beds for further purifying the sewage, but as this part of the project was not approved, it was not installed, but can be easily constructed whenever it becomes expedient.

VII. Furniture: All furniture and fittings, with the exception of the chairs for lecture room and library, were constructed of Spanish cedar, under agreement, by Antonio Vila, from designs prepared by this department. The lecture room and library chairs, also designed by this department, were built of oak, finished to harmonize with the other furniture, and were furnished by Champion, Pascual & Weiss. The furniture is divided into 7 distinct types, as illustrated by the accompanying photographs: (1) Working counters, (a) bacteriological and histological, (b) chemical, (c) hoods; (2) supply and instrument cases, (a) laboratory, (b) professors' and advanced workers' room; (3) tables; (4) desks, (a) professors', (b) lecture room; (5) dust-proof case; (6) museum cases; (7) bookcases.

The working counters are of two types: (a) as shown in the histological laboratory, and (b) as shown by the chemical laboratory.

(a) The counters in the bacteriological laboratories are 2 feet 6 inches wide and 3 feet 6 inches high, with a row of drawers and shelves below, and shelf racks for chemicals above, each rack containing two shelves 7 inches wide, each divided into two parts, thus accommodating 4 men to each rack. Along the tops are arranged 20 hose cocks of latest design for Bunsen burners, and as these laboratories are designed to accommodate 19 men at a time, the counters are divided into 19 separate divisions, each 4 feet by 6 inches long, each section being provided with 2 drawers, a shelf rack for chemicals, and a hose cock, as already mentioned.

(b) The working counters in the chemical laboratory are also of two different types, though of similar design, one extending along the two side walls, the other in sections 16 feet long, extending transversely the length of the room, and, being alike in all appointments, a description of the latter will answer.

These counters, 4 feet wide and 16 feet long, each contains 8 separate desks, 4 on a side, with a double row of shelves 12 inches wide extending through the center.

Digitized by Google

Each individual desk contains one cupboard 18 inches wide, 32 inches high, a compartment 9 inches high, 27 inches wide, with a drop front, and 4 drawers for miscellaneous articles. The shelf rack above provides accommodations for individual supplies of the usual acids required in this department. Each desk is also provided with an independent hose cock.

(c) The hoods for obnoxious fumes are located at the south end of the chemical laboratory, and are each 3 feet by 3 feet 6 inches, in one piece, 9 feet 8 inches high, with a row of drawers and shelves below and a counter on each side, one containing a sink, the other a shelf rack for chemicals. The upper portion of these hoods are lined with copper, and are ventilated by a copper-lined ventilating flue, extending above the roof. Each hood is also provided with two hose cocks, thus furnishing accommodations for 4 men at a time.

(2) The supply and instrument cases are also of two types, (a) as provided for the general laboratories, and (b) as provided for the professors and advanced workers. There are four of former, three 10 feet long, and one 8 feet long, 7 feet 6 inches high, consisting of a base 36 inches high, 18 inches deep, forming cupboard, with a top part 4 feet 6 inches high, divided into two parts, and provided with three shelves each, inclosed by glazed doors. The second are of similar design, 4 feet 6 inches long, but with a base 36 inches deep instead of 18 inches, as are the laboratory cases.

(3) The tables are all of similar design, and vary only in dimensions. The large tables each contain eight drawers and a shelf below, with the exception of those in the histological laboratory, in which the shelf was omitted, to permit their being used as working tables in connection with the wall counters, should necessity demand it.

(4) (a) The desks in the professors' rooms are similar to the ordinary flat-top office desk, and need no comment, though the lecture-room desk, 16 feet long, is provided with all the accommodations of a practical working counter, a porcelain sink supplied by cold water through a N. P. pantry cock, three gas hose cocks, two cupboards, and a chest of drawers.

(5) The dust-proof case provided for the professor of bacteriology was especially designed to render it as nearly tight and free from dust as possible. As already mentioned, it is 4 feet wide and 6 feet long, with plate-glass windows and doors. Inside is a cupboard 2 feet by 4 feet (the interior of which is black), with three shelves, and inclosed by a pair of double doors with rabbeted edges lined with rubber; working counter 2 feet by 4 feet is also provided, leaving a free working space of the same dimensions. The door of this case is double rabbeted, edges lined with rubber to render it perfectly tight, and as all joints are rabbeted and glued, the case will undoubtedly prove to be, as designed, dust proof.

(6) The museum cases, in addition to what has been previously stated, have paneled ends, and a small but effective cornice of similar design to the other cases, giving uniformity of design to all the furniture, which has been carried out as far as possible.

(7) The bookcases for the departmental libraries are of simple design, 6 feet high, with four adjustable shelves divided into three panels each about 5 feet in length, and sufficient to accommodate six to seven hundred volumes. The furniture, with the exception of the counter tops, is of natural finish; the tops, however, have been treated by a special process prepared by the department.

VIII. The old floors, all of yellow pine, though in bad condition, were repaired and patched, so that, while not new, they were left fairly good and substantial. Many other miscellaneous repairs were made to the old plaster work, inside and out, and to the existing woodwork, window frames, doors blinds, etc. Four-inch partition moldings were carried around the tops of all partitions, new baseboards were put in the principal rooms, and new door trim was put on the doors of all the professors' and advanced workers' rooms, libraries, and lecture room. New panel moldings were put on one side of all the doors, none ever having been provided. Two pairs of new Spainish cedar doors were built for the lecture room, in which room all new finish is of Spanish cedar. New bronze hardware was put on all windows and doors, and included top and foot bolts, flush bolts, butts, double-acting and spring hinges, push plates and locks with bronze escutcheons and jet knobs.

IX. The buildings have been newly renovated inside and out, all exterior walls receiving two coats of whitewash, the interior walls two coats of alabastine, while all woodwork, inside and out, received two coats of paint. The counter tops in all laboratories, as previously mentioned, were treated by a special process prepared by this department as follows: One coat of filler, consisting of 1 pound iodine, 1 pound creosote, 3 ounces tannate of iron, rubbed, when dry, with very fine sandpaper; two coats of black paint, consisting of 1 pound Germantown lampblack dissolved in one pint alcohol, and 1 pound shellac dissolved in one pint of alcohol (thinned with alcohol

Digitized by Google

if too heavy), the first coat, when dry, rubbed with very fine sandpaper; one coat of wax, consisting of 1 pound paraffine, 1 pound beeswax, 1 pound clear linseed oil. Put on hot and as much applied as necessary, rubbed to a smooth finish with cotton cloth. This process produced a dull black surface, which, with rendering the tops free from the effects of acid, was the object in view.

Additional work.

1. Carriage shelter: No provision having been made for sheltering carriages, the military governor directed that the department erect a carriage shelter, which was located directly in the rear of the east wing. This shelter was for four carriages, and was 34 feet 6 inches long, and 15 feet 6 inches deep, with a 4-foot 6-inch overhang, making the four stalls each 8 feet wide and 20 feet long. It was constructed of yellow pine with 6 by 6 inch posts, sheathed outside and inside with matched and beaded sheathing, 6 by 6 inch plates, 4 by 6 inch hackets supporting a 4 by 4 inch purlin for the overhang, and 2 by 6 inch rafters covered with ⅞ by 4 inch matched and beaded sheathing, face down. The rafters, posts, and plates being of dressed timber, the framework is all exposed, and is all finished natural. The roof was covered by marseilles tiles which were removed from an old shed in the quadrangle, which was torn down.

2. Exterior plastering: No provision having been made in the original estimate for plastering the exterior of the wings, a second appropriation was recommended to do this work. The cornice and parapets of the west wing had already been completed, but those of the east wing were left unfinished, making it necessary to extend the existing brickwork on this parapet 12 inches by 6 inches by 130 feet with the top row of brick, extending so as to form a back for the molding, which was run in cement. The main cornice was of cut stone, and required plastering only. All moldings were run by a wooden form with a G. I. pattern on a track which gave a smooth and true molding with the least possible work. The walls were plastered two coats, with a floated cement finish. They were broken by numerous pilasters and window trims, which required much additional labor. Thus, 130 feet of main cornice, and 130 feet of parapet cornice, and 84.4 squares of surface were covered by this appropriation, leaving the building complete and finished in every respect.

Improvement of grounds.

The grounds in front of the buildings were low and irregular, inclosed by a high dilapidated wooden fence which was in poor condition, and so detracted from the appearance of the newly renovated buildings, that the military governor directed that they be improved. The old fence has been removed; a branch of the Zanja system of irrigation ditches, which separates the property from the avenue Carlos III, is to be conducted through a box culvert, 32 feet of which has already been built, and the whole front is to be raised, graded, sodded, and otherwise embellished, and inclosed by a concrete curb. The corners at the ends of the main building are to be inclosed by a wrought-iron fence 3 feet high, on a wall 2 feet 6 inches high, which is already in place. When concluded the whole site will have been left in first-class condition, and will present a neat and attractive appearance.

Cost of furniture.

BACTERIOLOGICAL.

Description.	No.	Design No.	Size.	Cost.		Total cost.
				Each.	Linear foot.	
Working counter	1	9	2′ 6″ x 100′ 6″		$2.70	$271.50
Counters in adv. laboratory	2	11	2′ 6″ x 27½′	$68.00	2.47	136.00
Counters in professors' room	1		2′ 6″ x 9′		3.33	40.00
Tables	4	2	4′ x 12′	21.00	1.75	84.00
	1	2	2′ x 16′	17.00	1.06	17.00
Lab. cases	2	7	10′ x 1′ 6″ x 7 6″	66.67	6.66⅔	133.34
Cases in adv. lab. and professors' room	3	8	4′ 6″	37.50	8.33⅓	112.50
Desk	1	15	4′ 6″	35.00	7.77	35.00
Dust-proof closet	1	14	4′ x 6′	125.00		125.00
Bookcase	1	3	15′ x 6′	25.00	1.66⅔	25.00
Total						979.34

Digitized by Google

Cost of furniture—Continued.

HISTOLOGICAL.

Description.	No.	Size.	Cost. Each.	Cost. Linear foot.	Total cost.
Working counters	1	2′ 6″ x 100′ 6″		$2.64	$265.50
Counters in adv. lab.	2	2′ 6″ x 27½″	$68.00	2.47	136.00
Tables	5	3′ x 12′	21.00	1.75	105.00
Tables	1	4′ x 4′			9.00
Lab. cases	1	10′ long	66.66	6.66⅔	66.66
	1	8′ long	54.00	6.75	54.00
Cases in adv. lab. and professors' room	3	4′ 6″ long	37.50	8.33	112.50
Desk	1	4′ 6″ x 2′ 6″	35.00	7.77	35.00
Bookcase	1	15′ x 6′	25.00	1.66⅔	25.00
Total					808.66

CHEMICAL LABORATORY.

Working counters	1	2′ 6″ x 131′		$4.00	$524.00
Working desks	8	4′ x 16′	$128.00	8.00	1,024.00
or	64	4′ x 4′	16.00		
Hoods	2	3′ 6″ x 7′ 10½″	75.00		150.00
Tables	2	2′ 6″ x 5′	12.00	2.40	24.00
Professors' cases	1	4′ 6″ long	37.50	8.33	37.50
Desk	1	4′ 6″ x 2′ 6″	35.00	7.77	35.00
Bookcase	1	6′ x 14′ 6″	25.00	1.72	25.00
Total					1,819.50

MUSEUM.

Cases	1	6′ x 7′ 6″	$40.00	$6.66⅔	$40.00
	1	15′ x 7′ 6″	100.00	6.66⅔	100.00
	6	8′ x 7′ 6″	53.33	6.66⅔	320.00
Total					460.00

LECTURE ROOM.

Desk	1	2′ x 16′	$64.00	$4.00	$64.00
Platform	1	5′ x 16′			
Chairs	96		5.00		480.00
Total					544.00
Total of all					4,611.50
Less deduction secured by giving entire work to one firm					310.50
Amount paid					4,301.00

SEPTIC TANK.

	Outside dimensions.	Cubic feet occupied.	Square feet.	Capacity (square feet)..	Gallons.	Accommodations at 50 gallons per capita.
Main tank	16½″ x 20′ x 7′ 10″	2,585	162½	975	7,800	156
Receiving basin	4′ x 5′ x 3′ 9″	75	9	15	126	
Total		2,600				

Digitized by Google

Cost of same:	
Per cubic foot	$0.80
Per gallon	.10
Per capita	4.99
Labor	298.84
Material	479.78
Total	778.62

Carriage shelter:	
Area	16 feet by 34 feet 6 inches.
Number of stalls	4
Cubic contents	6,440
Cost per square foot	$0.60¼
Cost per cubic foot	$0.052
Cost per stall	$83.51
Labor	$114.62
Material	$219.39
Total	$334.03

	Area.		Cost per square yard.		Labor.	Material.	Total.
	Squares.	Yards.	Labor.	Material.			
CONCRETE FOR FLOORS AND PAVEMENTS. [a]							
Main building W	10.5	116	$0.37½	$0.81½	$43.58	$92.47	$136.05
Main building E	10.5	116	.538	.77½	62.31	89.90	152.21
East wing	10.17	113	.37½	1.09	42.37	122.98	165.35
West wing	10.50	115	.371	1.05	42.68	120.32	163.00
Vestibule	7.70	84	.427	1.09	36.17	90.61	127.78
Vestibule drive	5.31	59	.886	1.59½	52.29	794.11	146.40
Total	54.58	603					890.79
CONCRETE FLOORS ON EXPANDED METAL. [b]							
Toilet	2.6	26.8	1.16	1.82½	33.50	52.81	86.31
Animal room	2.25	25	.57½	1.82½	12.88	45.58	68.46
Do	1.5	16.6	.698	1.82½	11.63	28.50	40.13
Total	6.35	70.4			58.01	126.89	194.90

[a] Total cost per square, $16.32; per square yard, $1.31. Vestibule drive was laid off in 4-inch squares; top coat, 1 inch.

[b] Total cost per square, $30.77; per square yard, $2.77; these costs include all lumber and labor for centers. New partitions including, studding, expanded metal, lath, and plaster, per square of one side, $30.03.

Plastering, per square:	
Interior work, 2 coats on brick wall	$4.92
Exterior work, 2 coats on brick wall	7.44

Latter price includes scaffolding and all preparation.

Porticos:	
No. 2—total length, 200 feet; width, 10 feet 6 inches; total area (square feet)	2,100
Cost per linear foot, $9.438; per square foot, $0.90; total	$1,887.64

The assistant engineer in charge of this subdepartment wishes to state that the completeness of the laboratories as a whole, is solely due to the chief engineer, Dr. Agramonte, and Mr. Videtto, the architect. Martin Fuhn was general foreman in charge.

Estimate.

75 squares concrete floors, at $20		$1,500
15 squares wooden floors, at $10		150
Removing old partitions	$112	
3 squares new expanded metal plaster partition, at $35	105	
		217
Cutting new openings	14	
Closing old openings	35	
		49
Plastering, patching, repairing walls where partition will be torn out, and plastering walls of east and west wings, 110 squares, at $9		990
Windows, glazing 53—2,120 square feet, at $0.60		1,272
Doors, 450 square feet, at $0.60		270
New plastered ceilings throughout, 120 squares ceiling joints, at $5	$600	
120 squares expanded metal plastering, 3 coats, at $14	1,680	
Suspending beams to truss to carry ceiling joists	225	
		2,505

Digitized by Google

Erecting colonnade around east and west wings, 21 columns, at $40	$840	
30 squares flat-tile roof, at $45	1,350	
10 parapet expanded-metal plaster wall, at $40	400	
		$2,590
New toilet room to be constructed at south end of east wing 30 by 30 by 20 high, at $0.20 per cubic foot		3,600
Plumbing:		
6 laboratory sinks, 24 by 42 by 7, at $40	240	
20 laboratory sinks, 17 by 24 by 6, at $35	700	
3 bath tubs, at $70	210	
3 showers, at $20	60	
3 slop sinks, at $60	180	
4 urinals, at $40	160	
6 water-closets, at $60	367	
4 basins, at $35	140	
10 partitions with doors, at $30	300	
425 feet 4-inch soil pipe under buildings to laboratory sinks, at $1	425	
		2,775
1,000 linear feet sewer pipe, at $1		1,000
Septic tank and filter bed		2,000
Water supply, 500 linear feet 1¼-inch pipe, at $0.30		150
Painting 300 squares, at $2.50	750	
Kalsomining 500 squares, at $0.70	350	
		1,100
Benches, desks, cabinets, etc., in bacteriological laboratory, long counter against wall with drawers below and shelves above, 100 linear feet, at $5 per linear foot	500	
4 tables, 4 by 12, at $1.75 per linear foot	84	
2 cabinets, 9 by 15 by 1¼, at $175	350	
		934
In advance scholars' room:		
15 linear feet counter as above, at $5	75	
1 table, 4 by 8, at $1.50 per linear foot	12	
12 feet counter, at $1.25	15	
1 cabinet	50	
	152	
2 rooms	152	
		304
Total		21,806
In professors' room:		
1 desk	30	
1 table	20	
1 cabinet	50	
		100
Histological laboratory, same as bacteriological laboratory		1,338
Chemical laboratory, 56 desks with drawers and cupboards below and shelves above, at $25	1,400	
130 linear feet counter similar to those in other laboratories	650	
2 hoods, at $100	200	
3 tables, 4 feet long, at $6	18	
Shelving in storeroom	100	
		2,368
Lecture room:		
Professors' working table		100
60 arm chairs, at $50 each		300
Museum:		
7 cabinets, 50 linear feet, at $12		600
1,000 feet gas pipe and burners for laboratories		150
150 combination gas and electric lights, at $12		1,800
Removing old buildings		200
Total		28,362
10 per cent for superintendence and incidentals		2,838
Grand total		31,200
If items 8 and 10 are omitted deduct $2,505 and $3,600 and 10 per cent		6,715
Net grand total		24,505

If this work is done by contract 15 per cent must be added to the total.

This estimate was indorsed as follows:

[First indorsement.]

DIVISION OF CUBA, OFFICE OF CHIEF ENGINEER,
Habana, October 16, 1900.

Respectfully forwarded to the adjutant-general, Division of Cuba.

This estimate has been made in accordance with the ideas of Dr. Agramonte, and though the time allowed for its preparation has been short, it is believed that the figures are substantially correct. Items 8 and 10 for new ceilings throughout, and for an extension of the building to be used as a toilet room, are desirable, and are rather insisted upon by Dr. Agramonte, but if necessary to reduce expenses, it is believed that they can be omitted without serious inconvenience.

Digitized by Google

The total estimate including these is $31,200, and exclusive of them, $24,505. These figures are for doing work by hired labor, and it is recommended that the work be done in that manner. If done by contract. 15 per cent should be added to these figures.

W. J. BARDEN,
First Lieutenant, Corps of Engineers, U. S. A.,
Acting Chief Engineer, Division of Cuba.

[Second indorsement.]

HEADQUARTERS DIVISION OF CUBA,
Habana, October 16, 1900.

Respectfully returned to the acting chief engineer of the division.

The within project of $24,505 is approved, and will be estimated for in the usual manner. Not more than $4,000 will be allotted for the installation of the work during this month, and the remainder, viz, $20,000, may be asked for on two separate estimates, as the rendition thereof becomes necessary, of $10,000 each.

By command of Major-General Wood.

H. L. SCOTT, *Adjutant-General.*

Estimate No 2, for improving front grounds of laboratories.

Filling, 950 yards, at $0.80	$760.00
Wall, 120 yards, at $10	1,200.00
Gate posts, 2, at $60	120.00
Piers, 12, at $30	360.00
375 linear feet fence, 3 feet high, at $2.50	937.50
22 linear feet fence, 6 feet high, at $5	110.00
1 chain at entrance	30.00
1,000 square yards sodding, at $0.20	200.00
Total	3,717.50

Estimate No. 3.

172 squares painting, at $2.50	$430.00
107 squares plastering on walls, at $7	749.00
8 squares plastering on parapets, at $21	168.00
10 cubic yards brick work, at $15	150.00
Total	1,497.00

Laboratory, cost of treating counter tops as described.

[Surface treated, 15.97 squares.]

Material:	
5 pounds tannate of iron	$3.75
1 pound tannate of iron	2.40
20 pounds paraffin	2.00
4 irons	4.80
8 pounds creosote	7.60
20 sheets sand paper	.20
100 yards muslin	40.00
20 yards flannel	4.00
10 gallons alcohol	5.00
	69.75
Labor	77.32
	147.07
Cost per square	9.20

APPENDIX N.

DEPARTMENT OF CUBA, OFFICE OF CHIEF ENGINEER,
Habana, Cuba, January 25, 1901.

SIR: I have the honor to submit to you the following report of operations on the topographical survey of the vicinity of Habana in conjunction with the survey of fortifications, for the six months ending December 31, 1900.

Very respectfully, your obedient servant,

JOSEPH A. SARGENT,
Assistant Engineer in Charge.

Maj. W. M. BLACK,
Chief Engineer, Department of Cuba.

Digitized by Google

SURVEY OF FORTIFICATIONS.

[Joseph A. Sargent, assistant engineer in charge.]

Organization of field and office forces on December 31, 1900.

One topographical field party, classified as follows: Mr. R. E. Bateson, topographical transitman, in charge; 1 recorder, 1 head stadia rodman (this rodman is also assistant topographer; sketches details), 2 stadia rodmen, 1 flagman and 2 helpers.

One secondary field party, classified as follows: Mr. E. J. Westerhouse, general instrumentman, in charge; 2 rodmen and in addition to these, 2 tapemen who work much of the time with the assistant engineer in sketching exterior lines of permanent fortifications, the remainder of the time with secondary field party. (The two latter-named men sometimes assist in blue printing, etc.)

Office force, classified as follows: One expert draftsman, 1 topographical draftsman (in charge of office when assistant engineer is in the field), 3 draftsmen, and 1 computer clerk.

Photographic force, classified as follows: Mr. Charles E. Doty, official photographer, 1 assistant photographer, and 1 helper.

Permanent fortification survey.

(Up to date this has included Batteries Nos. 1, 2, 3, 4, 5, and Santa Clara, and partial surveys of El Morro and Atares.)

Authority: The carrying on of this work by hired labor was approved by indorsement dated November 2, 1900, Headquarters Division of Cuba, file No. 1236. Office chief engineer, Division of Cuba, file No. 259–1.

Traverse work at the batteries: On the permanent fortification survey, field notes have been taken empracing all ground plan data in the modern seacoast batteries defending Habana, namely, Batteries Nos. 1, 2, 3, 4, 5, and Santa Clara. Exterior and interior traverses were run at each battery; the exterior traverse being used to locate exterior lines of the battery and the interior traverse used as a reference line in sketching interior details. These traverses were closed and balanced before the working drawing was begun, with an accepted maximum closing error of 1/5,000 and they were then platted by rectangular coordinates, with reference to a true meridian, and used as a basis upon which to project all details. The maximum closing error is the same as that accepted by the present city survey (department of streets), but results show that with the pains taken to insure this degree of accuracy, we usually obtain an apparent closing error something better than 1/10,000.

Detail work: Sketches have been made embodying numerous cross-sections and carrying essential data for completion of detail drawings of the above-mentioned coast batteries. Working drawings for all coast batteries above-mentioned, except No. 1, which is practically finished, have been made. Detail sheets showing cross-sections, construction, and details of battery buildings, magazines, etc., have been completed of Batteries Nos. 5, 4, and 3, and partially completed of Santa Clara.

Coast battery photographic work: Photographic work has been and is being done in conjunction with detail sketching. The combined result of detail drawings and photographic data will excel in thoroughness of detail results of similar work as shown by inclosures Nos. 3 and 4 of the final report of the survey of temporary fortifications, dated April 10, 1900. The more definite line of masonary construction and better chances to select points of view is conducive to more systematic collaboration of photographic and field sketched data than was possible in making the survey of temporary fortifications, where field works were partially obliterated and where views were frequently limited by growths of underbrush and weeds.

Miscellaneous remarks.

A stadia topographical survey has been made covering the territory embracing the coast batteries. As soon as contours can be developed from the field notes all topography will be projected upon the working drawings of the respective batteries, and the finished drawings will be traced and prints be struck off for record. Office work is being pushed with this end in view. The Spanish plans of the coast batteries which are on record in this office are, in each case, found to be plans of the original project, as was remarked upon in the report for fiscal year ending June 30, 1900. During construction of the batteries, dimensions and miscellaneous details were extremely modified or changed from the details of the original projects, which made necessary the field survey and detail sketching just finished by the secondary field party. Reference is made to *Enclosure No. 1, this embracing photographs of working drawings, which it is believed are self explanatory.

Digitized by Google

Topographical survey of the vicinity of Habana, in collaboration with survey of permanent fortifications.

General progress of field work: At the time of the adoption of the present project, a tertiary triangulation system and a map of the Department of Habana had just been made to accompany the report of the survey of temporary fortifications. The tertiary triangulation system and this map of the department was used as a basis upon which to begin the development of a topographical map. This map of the Department of Habana, made to accompany the report of the temporary fortification survey, was compiled from many sources. Main roads were traversed by stadia and minor roads and small villages were sketched by Batson board method. Streams and details of a miscellaneous nature were located by compiling from the best available original Spanish surveys (said data being culled from the archives of Cuba). The topographical map under way, then, is simply a further development of topographical features of the environments of Habana, using new data obtained by a stadia topographical survey. After July 1 field notes with good field sketches were taken for nearly all the territory lying north and west of the Marianao Railroad and east of the Almendares River. From this region the work was extended in a west to east topographical belt from Cerro toward Jesus del Monte, utilizing the road between The Palatino and El Mazo as a southern boundary and carrying the work north and east from said road toward and around Atares Castle. The survey was then continued east of Jesus del Monte as far as the Pastrina Rivulet and the Luyano River and north toward Habana Harbor. At this point, after carefully referencing the last observation stations, the topographical field party shifted to the east side of Habana Harbor entrance. Territory is now being developed which is bounded on the north by the Gulf of Mexico, on the south by the bluff crest which runs east from Cabanas past Fort San Diego toward the field work San Pedro, on the east by the Cojimar River, and on the west by the Habana Harbor Neck. The working scheme of the survey at present is to complete a solid area around the harbor, progressing inland with the city survey as a nucleus or working center. Attention is invited to inclosure No. 2,[1] this being a diagrammatic chart showing progress of the topographical field work, which, up to date, has been hugging the city limits, dovetailing with the city survey.

Detail sketching: To aid the draftsman interpolate field notes for the finished map, field sketches, showing details and traces of intersecting ground planes which surround each observation station, are made roughly to scale, and it is believed that this will avoid danger of a misconstruction of the field notes in developing large-scale detail sheets, preliminary to projection of data upon the finished map.

Base-line work: In the month of August Mr. Whitney, assistant engineer of the department of streets, in conjunction with the assistant engineer of the department of the survey of fortifications, measured a new base line with the aim of coordinating the data of the two departments for common use. This base line was measured south between tracks of the United Railroads of Habana from near the south switch at Cienaga. This base is marked at each end by a copper bolt set in a neat cement cap, both cap and bolt resting in an 8-inch earthen drainpipe full of rammed concrete. The drainpipe is flush with the ground line and was packed in a concrete bed before it was rammed full of concrete.

The probable accuracy of this base, accepted from computations made by Mr. Ritchie, assistant engineer of the city survey, is something better than 1/250,000.

The department of streets is now taking up computations of the city triangulation system, which is computed from above-mentioned base, and the resultant data of the city survey triangulation will be incorporated as part of the working center of the topographical map now being drawn.

Considerable care is needed to guard against wasting time by overlapping stadia work upon suburban areas developed by the city survey department (department of streets), therefore frequent consultations are held with the head of that survey, and as far as possible definite boundaries are agreed upon. The stadia work is then developed up to these bounding lines, and center-line courses are "tied to" the outlying lines of the street department traverses. It is to be remembered that the maximum closing error of the city survey is 1/5,000, while the maximum closing error of the topographical stadia survey in filling in between accurately balanced traverses is 1/300 (usually it runs better than 1/500). Close attention is paid to these areas where the city survey merges into the outlying stadia work, in order that in all cases details shall be located by the survey having the most practical closing error.

Under the present working scheme it is believed that we will in no case waste

[1] Omitted.

Digitized by Google

time by duplicating work. As soon as a solid area around the harbor and the city has been topographically developed, the inland open country can be developed with greater rapidity, having then no junction of suburb and city surveys to make.

Office work: In the office Señor Pichardo has reduced all traverse data from the city survey traverse sheets and has transferred same on the topographical map, as far as such traverses have been platted. He is now about to develop contours of the city proper from street levels furnished by the department of streets. The areas lying between and around Principe Castle, Animas, and Hill of Jesuits have been fully developed to show contours of 2-meter interval, and this data has been projected upon the final map. The geometric traces of the modern seacoast batteries defending Habana have also been projected on the finished map. The topographical draftsman has one large detail sheet practically developed of territory west of Principe. The reduction of the field notes has been completed in eight books.

Miscellaneous remarks: It may be no more than fair to state that during September and October three draftsmen and one instrument man were attacked by yellow fever. One draftsman, Mr. A. F. Westerhouse, died, the other three men recovered and were at work again inside of a month after being attacked with fever. One other draftsman who was not sick became panic stricken and left for New York. The office force was crippled for about six weeks. The sudden attack by fever of the working force is difficult to explain, since the three draftsmen and the field man boarded at different places, and since the men have lived in Habana from nine months to a year and a half respectively, and had previous good health. Before this attack of fever, and since these men recovered, no man in the subdepartment has lost time on account of a serious ailment.

It is perhaps worthy of note that on the topographical field party, except for the recorder and the head stadia rodman, the subordinates are Cuban young men who were selected after being employed some weeks on trial. In each case the prospective stadia man began as a helper, stake packer, or flagman, being promoted to stadia rodman only when he had shown himself to be of fair judgment, energetic, and quick footed. The Cubans employed as stadia men were "green timber" nine months ago, but they are fast becoming well-seasoned stadia men. They talk little or no English, but rapidly learn to obey signals from the transit.

About once each month it becomes necessary to establish a few wye-level bench marks near the origin and termini of stadia traverses, between which bench marks the stadia levels are balanced. This is done by the instrument man of the secondary field party and usually consumes from two to four days.

Photographic work: The photographer engaged in the taking of the detail and panoramic views pertaining to the permanent fortification survey has also been continually doing miscellaneous detail photographic work for other subdepartments. This miscellaneous work pertains to construction and reconstruction done by the engineer department in and around Habana. Since this photographic work was sandwiched between regular work done on the permanent fortification survey and since the photographer worked for several subdepartments at the same time, no attempt has been made in this report to itemize the innumerable small jobs to which reference has been made in previous monthly reports.

Financial statement.

Cost of permanent fortification survey field work (counting cost of maintaining secondary field party)	$2,024.50
This work, as shown above under heading "Authority," was done by hired labor.	
The nearest approach to a fair unit of cost would probably be the cost of the survey per acre, but this varies with each acre according to the number of details.	
Considering the total acreage of coast batteries, which is approximately 34¼ acres, the cost per acre is $90.70.	
Cost of topographical field work (counting cost of maintaining topographical field party)..	3,128.00
Since the topographical field party has been hugging city limits it has been doing a class of work which makes it impossible to compile from facts a typical square mile of open country. Considering a fairly open strip lying between Cerro and Jesus del Monte (see inclosure No. 2[1]), an area approximating 1⅝ square miles was developed in one calendar month, which included 4 Sundays, 2 rainy days, and 1 holiday, and 23 working days. In this area, counting cost of maintenance of field party, work cost 50 cents per acre or $125 per square kilometer. Three thousand observations were made over this area, making 11 shots per acre and a center traverse line of 5,600 meters. The following tabulation is made to be read in connection with diagrammatic chart (inclosure No. 2[1]):	
Amount for maintenance of office force (salaries only).....	2,941.67
Photographic department (salaries only)[2].....	1,380.00

[1] Omitted.

[2] See remark made under the heading "Photographic work" regarding the amount of work done for other subdepartments.

Digitized by Google

Material and minor expenses, materials used in the office and in the field by the topographical and permanent fortification survey parties (minor repairs, exigencies, reimbursements)	$324.11
Photographic instrumental expenses, chemicals, plates, paper, etc	515.15
Outstanding liabilities from fiscal year ending June 30, 1900 (these were paid during the past six months)	518.34
Salary of assistant engineer in charge of survey of fortifications, at $150 per month for six months	900.00
Total amount expended during six months	11,731.77
Expenditures during the six months with the outstanding liabilities for the fiscal year ending June 30, 1900, deducted	11,213.43
Outstanding liabilities on January 1, 1901	169.42
Actual expenses incurred during six months	11,382.85

Tabulation pertaining to the cost per unit of area, considering cost of maintaining field party only.

Areas considered.	Approximate area.	Total number of observations.	Number of shots per acre.	Length of center line in both lines.	Cost per average unit.
				Meters.	
Areas of line east and branch line east, see inclosure No. 2.[1]	1.8 square miles, or 1,152 acres.	3,000	11	5,600	50 cents per acre, or $125 per square kilometer.

[1] Inclosures omitted in printing report.

It is believed that the cost per square unit will be greatly reduced when the first belt around the city is completed.

Digitized by Google

INDEX.

Page.

Abattoir. Habana 176
Allis, Edward P. Commendation 4
Animals.
Condemnation and sale of 156
Cost of maintenance 156
Army officers. Commendation 1
Atares Castle. Repairs 225
Audiencia and carcel. Repairs 190
Baracoa. Operations at 105
Blank forms, proposed new. Criticisms 113
Brown, W. M., jr. Commendation 3
Building, construction, and repair. Work of 52
Cabana Heights, water tower. Erection 232
Cabana, immigrant station. Repairs 218
Carcel and audiencia. Repairs 190
Cement testing plant. Operation of 172
Cienfuegos. Operations in 72
City wall, old. Improvements around 162
Columbia Barracks and Vedado road. Work on 79
Columbia Barracks. Road work in post 80
Cortina de Valdes. Improvement 160
Cremation 153
Cuban labor 147
Customs funds.
Administration and rural guard 55
Barracks and quarters 56
Justice, public buildings 61
Municipalities, hospitals, and charities 62
Municipalities, instruction 60
Municipalities, sanitation 58
State and government jail 61
Dady, M. J. Orders concerning sewerage project, etc 4
Delgado, Dr. J. M. Commendation 64
Department of general repair and superintendence of municipal building. Operations of the 174
Department of sanitation and renovation of public buildings and fortifications. Operations of the 188
Department of street cleaning and parks. Operations of the 148
Department of streets.
Entire work accomplished 146
Operations of the 137
Department of water and sewers. Operations of the 163
Department of works of the port. Operations of the 179

Digitized by Google

	Page.
Department tug. Repairs to	152
Drafting force. Work of	189
Dragones Barracks. Repairs	211
Dredging. Works of the port, operations	180
Eastern Cuba. Organization and regulations for engineer department	96
Electric plant, Fuerza. Repairs	195
Electrozone.	
Comments on	123
Practical use and tests	114
Review of comments on	124
Electrozone plant.	
Cost of	127
Output	173
Employees.	
Commendation	112
Daily average of number employed, etc	157
Number and wages of	155
Engineer department, Habana.	
Statement of expenses, payments, and liabilities	130
Summary receipts and expenditures	188
Engineer officers. Stations and duties	2
Engineer operations. Summary of	1, 3
Fire hydrants	164
Fortifications. Surveys in connection with	244
Fosos. Distribution of work	144
Fuerza electric plant. Repairs	195
General hospital. Supplies transferred to	64
General office force. Work done	128
Habana.	
Abattoir	176
Blank forms proposed, new	113
Length and classification of streets	138
Operations at	106
Operations of engineer department in, summary	3
Orders concerning Dady project of sewerage system, etc	4
Plans sewerage system	170
Proposals for sewerage system, etc	12
School of Painting and Sculpture. Construction	210
Statement of expenses, payments, and liabilities, engineer department	130
Street work	140
Surveys vicinity of	54
Topographical surveys in vicinity of	242
Habana Institute. Repairs	215
Habana and Pinar del Rio. Map of	8
Hobby, A. S., jr. Commendation	90
Holguin. Operations at	103
House service pipes	163
Immigrant station, Cabana. Repairs	218
La Fuerza. Restoration of	158
La Punta	
Harbor. Improvement project	187
Sea wall at. Construction of	160
Maestranza building. Repairs	218

Digitized by Google

Page.
Manzanillo. Operations at 102
Marianao and La Playa road. Work on 81
Marianao.
Death rate 83
Sanitary operations 82
Matanzas. Operations at 70
Mercedes Hospital. Repairs 227
Mitchell, Mrs. Commendation 64
Monserrate street buildings. Removal 209
Municipal architect. Office of, operations 177
Municipal contracts. Draft of law governing 7
Municipal vivac. Repairs 222
Municipalities. Sanitation, receipts and expenditures 58
Night soil. Removal 172
Nispero Bay. Wharf 95
Old City Wall. (*See* city wall.)
Palatino pumping station. Construction 175, 210
Palatino reservoir 167
Parks. Care and preservation of 153
Passenger landing building. Repairs 196
Pay department. Operations of the 129
Piles, Wooden. Treatment and condition of 183
Pinar del Rio and Habana. Map of 81
Property department. Operations of the 137
Quemados.
Commissary and quartermaster storehouse road 81
Sanitary operations at 78
Quinta de los Molinos. Repairs 195
Quintard, Mrs. T. W. Commendation 64
Receipts and expenditures engineer department. Summary 188
Reconstruction. Works of the port 179
Refuse. Collection and disposal of 152
Regla. Street work 145
Repair shops. Operations of 157
Repair work. Statement of, done 158
Road. Columbia Barracks and Vedado 79
Roberts, Lt. H. A. Commendation 56
San Diego Battery. Repairs 221
Sanitary plumbing 171
San Luis. Operations at 106
Santa Clara.
Operations at 73
Public works at 76
Santiago de Cuba.
Harbor improvements 89
Operations at 84
Pavements 89, 99
Road work 92
Sewerage 90
Specifications for pavements 99
Santiago school. Construction 215
School of Painting and Sculpture, Habana. Repairs 210
Sewer Department 169

Digitized by Google

	Page.
Sewerage system, etc., Habana.	
Orders concerning	4
Plans for	170
Proposals for	12
Sewers. Maintenance of	169
Special service. Guards and watchmen	154
Special works. Projects	158
Stable No. 2. Condition of	155
Stable No. 3. Condition of	156
Street department. (*See* Department of streets.)	
Street work. Habana	140
Streets. Length and classification of, Habana	138
Suburban water supply	165
Tacon street sewer. Extension of	160
Tide observations	183
Topographical surveys. Operations on the	242
University of Medicine. Laboratories, repairs	232
Vento stone.	
Cost of	147
Plant	146
Vento waterworks	167
Water department	163
Miscellaneous work	168
Water-main system	164
Water meters	168
Water surveyors	168
Water tower. Cabana Heights, erection	232
Wharves. Works of the port, care and repair	180
Wilson, W. A. Commendation	90
Works. Cost of the several classes of	222
Works of the port.	
Miscellaneous works	182
Operations of the division of the	51

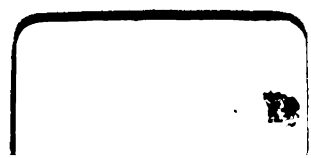
Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google